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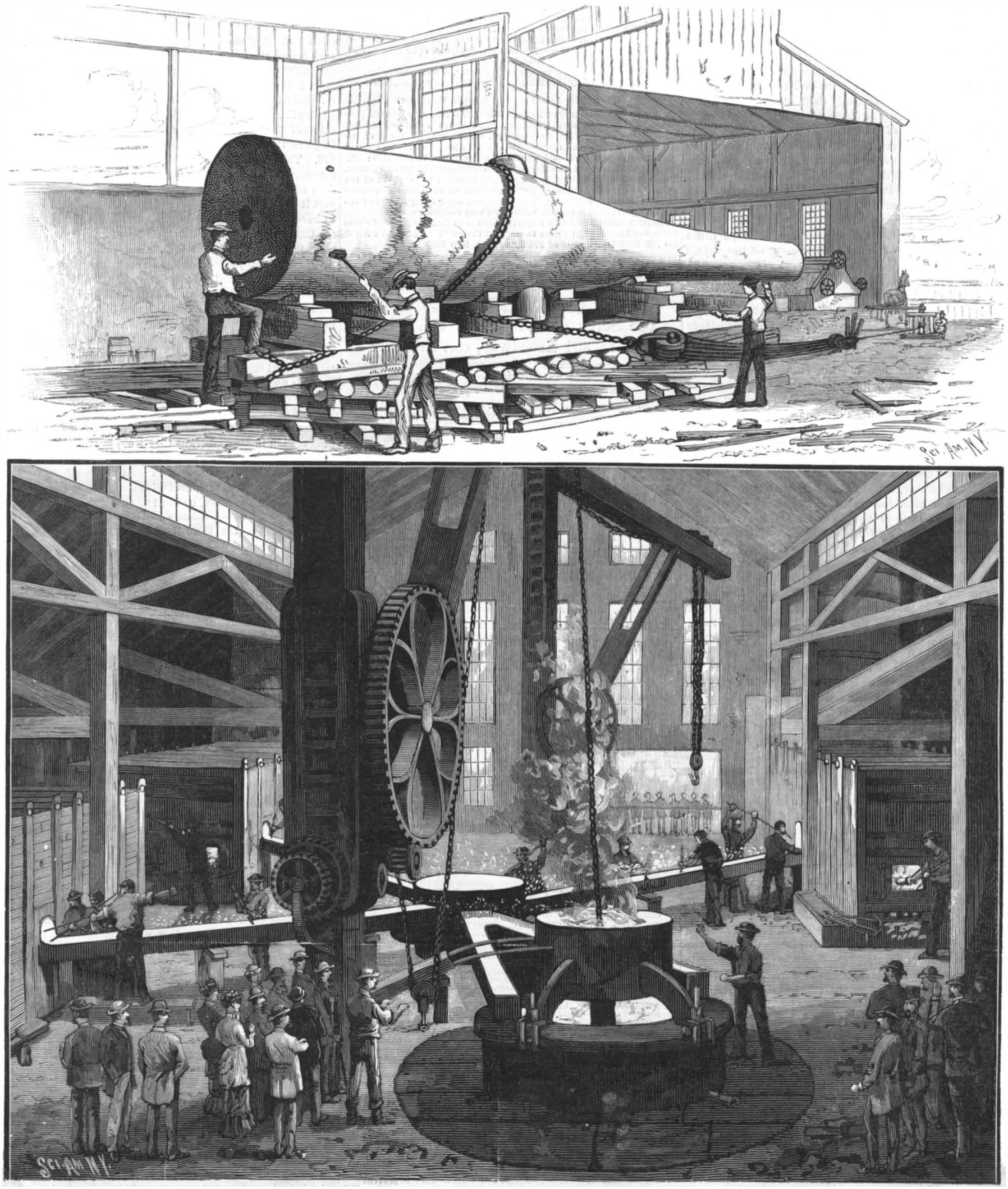
CASTING A HUGE CANNON.

In the ordnance foundry of the South Boston (Mass.) Iron Works is a large pit which is always used when guns of extraordinary size are to be cast. The pit is about 40 feet deep, is built in a circular form, and the outside is composed of large iron plates riveted together; and as the bottom of the pit is below the water level, every precaution was taken, during construction, to make it absolutely watertight, since the entrance of a small quantity of water during the casting would ruin the work, and endanger the mould and pit. Next to the iron plates is a brick wall one foot through, and inside of which is a thick layer of sand and cement. The floor is of brick and cement; and is still further strengthened by wrought iron girders covered with cement and sand. Over the whole is placed an iron cover an inch thick, and upon this floor the casting rests. Great strength is necessary in these parts, since the gun weighs some one hundred and twenty tons, and the whole load is concentrated upon a space about five feet in diameter.

The mould is prepared in a heavy iron flask that is made in sections, and is held together by bolts through flanges and



CASTING A GREAT CANNON AT THE SOUTH BOSTON IRON WORKS.

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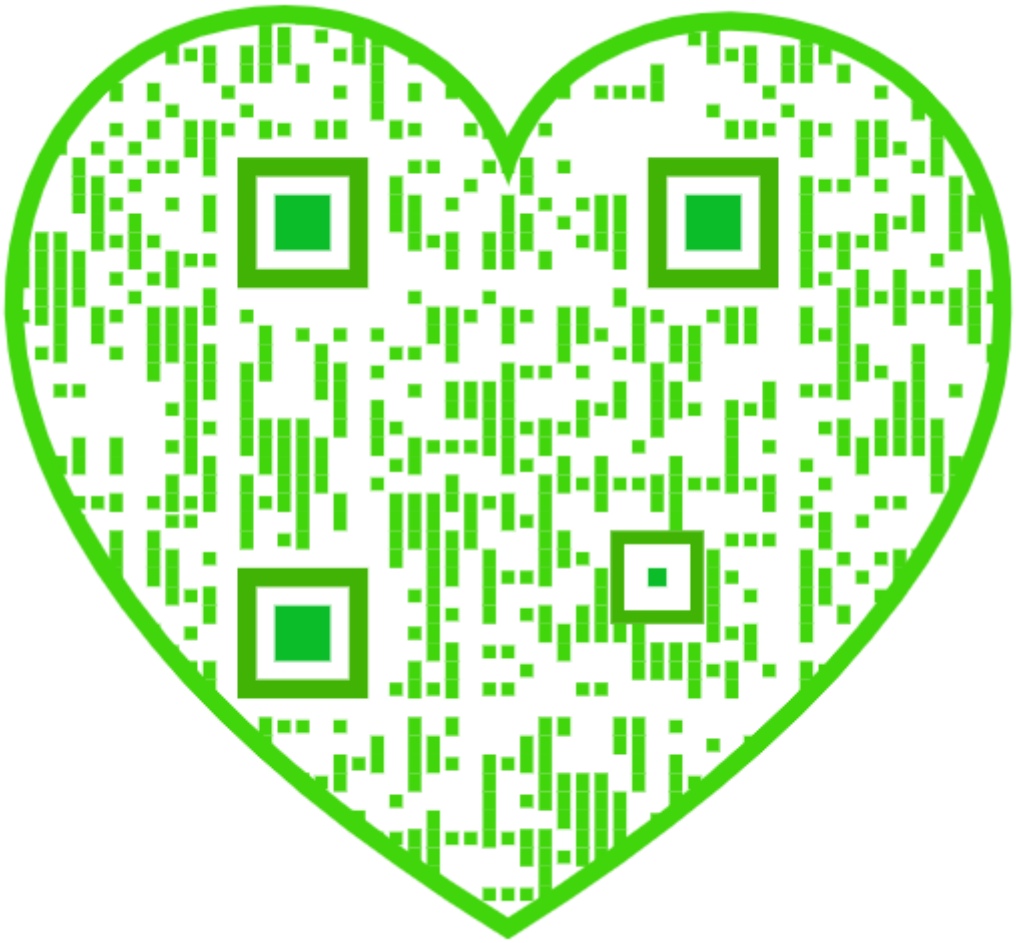

clamp fastenings. These sections are built up, one upon another, until the mould—placed vertically in the pit—reaches to the surface. This is lined with a thick layer of cement and sand to resist the heat of the melted iron. The cavity in the mould to receive the molten iron is 4 feet 9 inches in diameter at the bottom or breech of the gun, 3 feet 7 inches in diameter at the top or muzzle, and 40 feet long.

The casting is done after the Rodman system—that of cooling from the interior. To illustrate the effect of this, the mass of iron we will suppose to be divided into concentric rings, the inner one of which cools first and contracts, when the second cools, shrinking upon and firmly uniting with the first. The third, fourth, and so on then cool in order. The effect of this, as illustrated in very large guns, is great uniformity of the metal and greatly increased strength, owing to the almost total absence of internal strains and because the pressure arising from an explosion is resisted by the circles formed in the shrinking.

In the guns cast after the old method of cooling from the exterior there was always a quantity of idle metal, so to speak, but by this plan each ring or circle does its part in withstanding the pressure, and the internal strains are so distributed that no part of the iron is subjected to strains in a direction abnormal to those which it assumed when cooling.

This cooling from the interior is effected by a hollow core, consisting of a wrought iron tube, about 9 inches in diameter, covered externally with clay to resist contact with the molten iron, and made perfectly tight at the bottom, but open at the top. This tube forms the bore of the gun when cast. A circulation of cold water is kept up through the interior, as near as practicable to the hot iron, in order to cool the casting from the bore outward, that the desired contraction may be toward the center for the purpose already described. As shown in the engraving, two pipes enter the open top of the core, one for the admission of cold water and the other for the exit of the water which has become heated by its passage through the core. The large drum shown just above the pit is designed to carry off the vapors arising from the casting.

On July 9 an attempt was made to cast one of these enormous guns. The mould had been made ready, and the furnaces had been going since the day previous. Each of the three furnaces, which are located at a little distance from the pit, as shown in the cut, contained 40 tons of iron. During the melting small rectangular specimens are taken from the furnace and broken, the appearance of the fracture serving as a guide in regard to the quality of the metal, which is carefully brought to the required standard. The difficulty of breaking these samples, each of which was laid across an opening in a block and struck many blows with a sledge before it yielded, indicates the great strength of the metal. When everything was in readiness, the furnaces were tapped and the molten iron led to a mixing chamber, from which it flowed to the mould. About an hour after the mould had been filled the heavy iron flask burst open at the bottom, when the column of melted iron, nearly forty feet high and about four feet in diameter, instantly settled to the bottom of the pit and formed a cheese 13 feet in diameter and 6 feet thick. As the pit was perfectly tight and dry no explosion took place, but as the mass fell to the bottom it went with such force that a small amount was thrown out to the roof, which, together with the foundry fixtures, was burned. The damage to the flask, the recovery of the heavy mass from the pit, and putting it in shape to be remelted, is a serious loss.

Our second engraving shows a gun being moved to the machine shop. The casting is remarkably perfect, no flaws or other imperfections being visible, and even the joints formed by the various sections of the mould being hard to discern. When finished, the gun will be 30 feet long, a portion being cut from each end of the casting, 56 inches in diameter at the breech, and the bore will be 12 inches in diameter. It will be a rifled breech-loader, and the method of operating the breech block will be the "interrupted screw system," erroneously called the French method. It will be worth $28,000—about half the sum that a steel gun would have cost—and, it is calculated, will be able to throw a projectile six miles.

Novel Form of Earth Plates.

A novel form of earth plate, in which a continuous process of depolarization goes on, has been devised by Mr. Justin Halisz, chief electrician to the Galician railways. In a square hole in the ground, about two meters deep and one meter square, there is placed a bed of coke of moderate thickness. Above this layer there is formed, by aid of a wooden tube, a column of coke six inches square reaching above the ground level, the earth being filled in around the tube. Near the upper part of the column, a few inches above the ground, there is placed a large piece of coke which has been immersed in molten lead, and to this there is connected a copper rod to which the conductor is attached. By this arrangement, the gas which forms in the soil can escape between the fragments of the coke and through the coke itself, and thus the earth contact is kept from polarization.

THE Belgian Government has officially invited all foreign governments to take part in the Universal Exhibition, which will be opened in Antwerp the 2d of May, 1885. The works, which have made this port one of the finest in the world, will then be completed and inaugurated.

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CONGRESS AND THE PATENT OFFICE.

Congress has made a slight increase in the appropriation for the Patent Office for the year ending June 30, 1885. The Commissioner asked for $650,000 on account of salaries for those employed in the department, but was allowed only $597,170; this, with the various changes made, will give an actual increase of 52 in the number of employes. It is to be regretted that Congress could not have been induced to deal more fairly with the inventors of the country. The Patent Office badly needs more room, and its business should have been confided to a separate and independent department, as was so ably advocated by Senator Platt. But, even if such action was rather crowded over than fairly considered, on account of the nearness of a presidential campaign, there was no good reason for cutting down the appropriation asked for by the Commissioner to increase the force in the office.

The business of the Patent Office has been notoriously in arrears for more than a year past. According to a report made by the Commissioner in April, there were at that time over 5,000 cases pending in the different divisions of the office. A large proportion of these were cases which had not yet received the first inspection of an Examiner, applicants having to "wait their turn" in a manner but little less tedious than if they were litigants before the Supreme Court. In each one of the twenty-five divisions the Examiners also report an urgent need of more room, as well as of additional help, it being impossible to keep the records and the data for reference in proper order for expediting the work. The injustice thus done to inventors is utterly inexcusable, for the receipts of the office above its expenses during 1883 were $471,000, and the surplus on the 1st of January last was $2,676,476. This is money which the Government has taken from inventors for the exclusive purpose of paying for the conduct of the business, and it is neither law nor equity to divert it from that channel. The inventors have paid enough to have their business not only done well but promptly; and for them to be compelled to wait for months to have their claims passed upon, from insufficient departmental facilities, is a great injustice. Some improvement may be possible with the increased appropriation for the ensuing year, although the increase is not what it should be, and it is more than likely that it will be overbalanced by the growth of the business of the Patent Office during the next twelve months.

Of the many bills introduced for the nullification of patents not one of which was passed, it should be particularly remembered that they did *not* die with the session. The snake is not killed, but was only scotched, by the indignant remonstrances which the proposed legislation elicited. These dangerous bills will remain on the calendar, and in the same position before committees, at the opening of the next session in December, as they were left at the adjournment. It behooves all who are interested, therefore, not to cease in their watchfulness, or in their active efforts for the prevention of such reckless legislation, while the present Congress is in existence, or until next March.

DRIVING BY FRICTION.

For many purposes for which gear wheels were formerly used surface friction wheels are now employed. If the surfaces are properly matched as to material, and are sufficiently large as to area, there appears to be no reason why friction wheels cannot be more extensively employed than they have been heretofore. One of the objections has been that there must be an end thrust, which by its friction absorbs much of the power. It is a baseless objection, as may be seen in the friction clutch of the overhead countershaft of the lathe, and in many other situations where the release of the friction is the easiest and most natural movement. To be sure, in this case the amount of contact is very large—the entire circumference of the pulley—but the principle is the same; for where the pulley friction clutch must be held as a one with the moving pulley, so the friction wheels are one so long as they are in contact, and their contact is a mere point against the circumferential contact of the pulley clutch.

An objectionable method of employing the friction driving is to use a metallic surface against a wooden or a leather surface; two surfaces of wood are better; but if iron and leather or iron and wood are used together, the driver should, in all cases, be made of the softer material. For when the driver is thrown in contact with the driven, it must make a number of revolutions before its contact will be sufficient to start the driven wheel. It is evident, therefore, that if the driver is of iron while the driven is of some softer substance, it (the driver) will wear a crease that will injure the surface of the driven wheel. It is much better, where it is practicable, to make both the driving surfaces of wood.

Excellent wheels are made of maple—hard rock maple—and of lignum vitæ, the lignum vitæ wheel to be the driven and the maple the driver. The wheels should be a cast iron spider made to receive the wood, which should be sawed into wedge-shaped or radial segments, so that the end grain of the wood bears and makes the contact surfaces. Excellent results have been obtained, also, with hard rubber (vulcanized) and wood, where there was no oil to rot the rubber, and for small wheels there is nothing better than raw hide as prepared for pickers for looms and for small gears. This will stand oil and resist its disintegrating influence.

One of the advantages of friction wheels over cogged wheels is that when they are started there is no shock, but only a gradual coming up to speed. Another is their noise-

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lessness; but the epicycloidal cutting of gear teeth latterly has made this objection untenable, as gears can be run as silently as belts. But a great advantage is the very slight movement necessary to connect and disconnect, the actual surfaces requiring to be merely and barely separated to insure a stoppage of motion.

VARIATIONS OF SPEED.

The contrivance of step cones with shifting belts is a cumbersome and troublesome one for procuring gradations of speed. In many cases it answers its purpose, but in others some more sensitive and intermediate device would be better. A change of speed is readily obtained by a change of position of a driven wheel on the face (side) of a driver wheel or disk. The face of this disk may be either straight or slightly dished, and the driven roll or small pulley traverses the face of the disk from the shaft to circumference. It is evident that while the driven wheel is nearest the shaft of the disk it will revolve the slowest; and also it is evident that as the driven wheel is run out toward the circumference of the disk it will revolve the faster.

The shaft of the driver—the disk—is, of course, at right angles to that of the driven pulley; these relative positions must be maintained. But it does not matter, in practice, whether the disk is on a horizontal or a vertical shaft, so long as the driven is so arranged as to be permitted to be placed in contact with the disk at any point from center to circumference.

This device, with some modifications, has already been employed in the machine driving of potters' wheels and in the foot driving of sewing machines. But it is capable of a wider adaptation, especially in the machine shop, where sudden changes or quick variations of speed are frequently necessary. The large disk may be of cast iron turned and finished, and the driven wheel of iron, leather faced, or of wood. The progress of the driven wheel from shaft to circumference of the disk—from low speed to high speed—could be controlled by lever, worked by hand or by foot treadle. It is a much closer and more sensitive device than the present system of absolute changes of speeds on our lathes and drilling machines.

THE GREELY EXPEDITION.

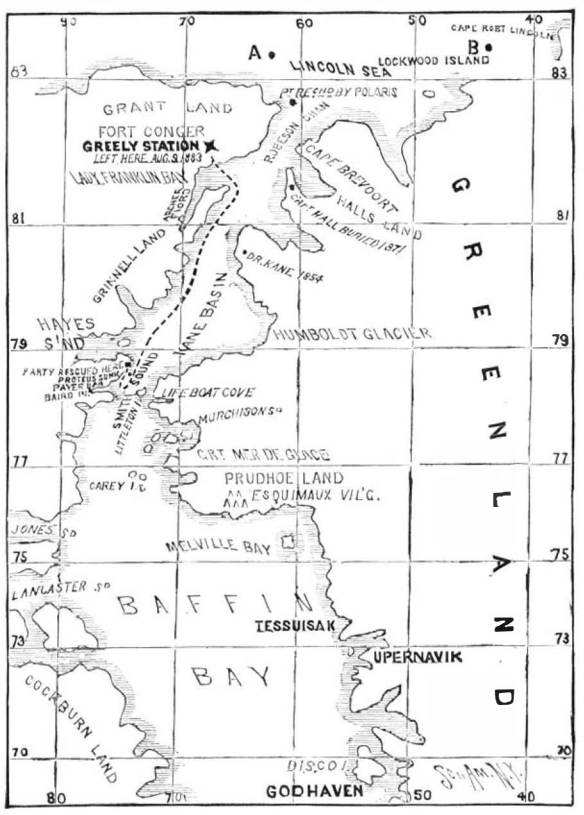
It was August 18, 1881, that the officers and crew of the Proteus bade good-by to Lieutenant Greely and his little band, twenty-five in all, leaving them in camp, as an advance guard of explorers, in a high northern latitude. The exploration in which they were engaged was not one for the advancement of material aims or the ambition of governments to enlarge their dominions—it was one solely in the interest of science, to widen the domain of knowledge, and help us to better know the laws which affect the conditions of life and growth on this planet, as well as to throw light, if possible, on that great field of research, so largely speculative, in which we are seeking to find out something of the universe. It was not until the 22d of June, 1884, a little more than two years and ten months after the party had been left on the shores of Lady Franklin Bay, that seven of them, the only living members of the original band, were relieved of their long vigil by the appearance of the vessels of the government expedition under Commander Schley. Seventeen of the others had died of starvation, one was drowned while sealing to obtain food, and of those found alive one died subsequently from the amputation of limbs made necessary by frost bite, so that only six of the original twenty-five remained alive to reach home again.

The story of the expedition, the plans of the scientific bodies and Arctic explorers which led up to it—in connection with several other observation posts around the pole—as well as the futile efforts of 1882 and 1883 to reach and relieve the colony at Lady Franklin Bay, have often been told. It was the understanding when the station was established—subject to the discretion of Lieutenant Greely, as circumstances might affect the situation—that if government relief did not reach the station during the summer of 1882, the party would endeavor to work its way southward in the summer of 1883 as far as Cape Sabine, or make its quarters on the west coast as far south as might be practicable, and yet within the possibility of being reached by a relief expedition, but that the route would be on or along the west coast, and not on the Greenland side. In accordance with this idea Lieutenant Greely abandoned his quarters at Fort Conger, on Lady Franklin Bay, August 9, 1883, and reached Baird Inlet, near Cape Sabine, September 29, with the entire party well up to that time. Great difficulty was experienced in getting to that point, with the instruments and records of observations, and as large a supply of provisions as it was possible to convey. He was obliged to abandon all his boats, and was adrift for thirty days on the ice in Smith's Sound, the party finally making its way across an almost impassable field of ice hummocks to a landing just north of Cape Sabine, where a permanent camp was established October 21.

Here the party found that a very insufficient supply of provisions had been left, while some of those thus obtained had been left by Sir George Nares as long back as 1875, and were of course much damaged. It was known that supplies had had been left on Littleton's Island, almost opposite Cape Sabine, on the east side of Smith's Sound, but the channel did not close all winter on account of violent gales and the strong currents, and there was no means of reaching the food that was so near. The party was immediately put on short rations, but on May 14, 1884, the last regular food was issued. After this the men were forced to live on boiled sealskin strips from their sealskin clothing, lichens, and shrimps, game having failed despite daily hunting from early in February.

One had died in January, 1884—the first death of the party—then five died in April, four in May, and seven in June, up to the 22d, when the rescue was made, and when, according to Commander Schley, "forty-eight hours' delay in reaching them would have been fatal to all." Too high praise cannot be accorded to Commander Schley for the energy with which he pushed north so early in the season, fighting his way almost inch by inch through the ice; but it will be remembered with a feeling of sadness, if not of severe reprobation, that three United States vessels, the Yantic, the Proteus, and the Neptune, had visited the near locality of Greely's fatal camping ground, during the summers of 1882 and 1883, with ample provisions, and come home again without leaving there the supplies that would have prevented these men from starving.

It is too early to say what will be the probable value of the information obtained by this expedition. Up to the fall of 1883 its success seems to have been all that could have been desired by its promoters, and in the journey southward copies were brought of meteorological, tidal, astronomical, magnetic, pendulum, and other observations, although some photographs, Esquimau relics, and other things were necessarily left behind. It is probable, however, that Lieut. Greely made all the observations required by the International Conference at Hamburg, under whose directions the various circumpolar stations were established, and that substantially all such records have been saved. The distinguishing work of the expedition—that which will perhaps give it most fame—is thus announced by Lieut. Greely: "For the first time in three centuries England yields the honor of the furthest north," which had previously been 83° 20′, but was marked at 83° 24′ by Lieut. Lockwood of the Greely expedition, on May 13, 1882. The point of observation was named Lockwood Island, where, "from an elevation of 2,000 feet, they saw no land north or northwest." To the east and northeast of Lady Franklin Bay the party undoubtedly made the best survey yet accomplished of northern Greenland, and, by observation of what seemed to be a distant headland, located it as Cape Robert Lincoln, in latitude 83° 35′, longitude 38° west of Greenwich.



At B, in our map, is shown Lockwood Island, the highest northern latitude yet reached, and from whence the observation was made, while A marks the highest point attained by Commander Markham, the most successful British explorer, in 1876. In a subsequent endeavor to go still farther north, the party was turned back by open water, and, as Greely's report says, "barely escaped drifting into the Polar Ocean."

There are many other newly named places, and some material changes will have to be made in the maps of regions hitherto incorrectly laid out, along the west shore of Kane Basin and Kennedy Channel, and in the configuration of Grinnell Land, and the north shores of Grant Land and Greenland. Arctic geography will thus, doubtless, be greatly amended, but whether the results attained will prove sufficient compensation for the loss of life of the brave men who were sacrificed is a query which many people will think most unsatisfactorily answered.

GLASS MAKING IN ITALY.—Colle de Val d'Elsa contains one of the most important glass works in Italy. The value of the annual production amounts to 2,500,000 lire; its sale extends over all Italy, but more especially in the Roman, Tuscan, and Piedmontese provinces.

LABELS AND TRADEMARKS.

In the year 1874, the duty of registering labels, hitherto performed in the office of the Librarian of Congress, was transferred to the Commissioner of Patents. In accepting this office the Commissioner for some reason imagined it a part of his duty, when a label was presented for registration, to exercise judicial functions in deciding whether it was a label or trademark from a *prima facie* standpoint. The label after one or more examinations was pronounced eligible for one of the forms of protection, except in comparatively rare cases, when something obviously neither one nor the other would be entirely rejected. In the numbers of the *Official Gazette* prior to 1882 several decisions of the Commissioner on this subject will be found. In virtue of such decisions many labels were refused registration on account of their arbitrary and non-descriptive character, and were brought into the trademark class. The definition of a label that was the working standard of the office was taken from Webster's Dictionary. It reads as follows: "A narrow slip of silk, paper, parchment, etc., affixed to anything, denoting its contents, ownership, and the like; as the label of a bottle or a package." (O. G., August 10, 1881.) From this it was assumed that a label must be descriptive of something connected with its object, and everything in the shape of an arbitrary or non-descriptive symbol the Commissioner refused to register except as a trademark.

This practice prevailed until the year 1881, when two very important events took place. The first of these was the passage of the new trade mark act of March 3, 1881. This was to replace the old statute, which had been declared unconstitutional. By it the additional restriction was placed upon trademarks, that in order to be subjects of protection by the United States courts they must be used in commerce with foreign nations or some Indian tribe. In the old practice of the Patent Office almost anything that they decided to be unregisterable as a label could be registered as a trademark. But this new restriction threw out a great many *quondam* registerable trademarks, and in conjunction with the Patent Office rulings deprived many labels of any registration whatever.

This state of affairs quickly became oppressive, and the important decision of the Supreme Court of the District of Columbia in the case of the United States *vs.* the Willcox & Gibbs Sewing Machine Company came in good time to relieve it. This was the record of the important events alluded to above. The court held that the Commissioner had no right to exclude from copyright registration any label under the guise that it was a trademark. The Commissioner at once accepted this decision, and changed the practice of the office to correspond therewith.

All went satisfactorily under the new ruling, and the interests of private individuals and of commerce at large were equally guarded. The Supreme Court, although it did not base its decision on the intrinsic qualities of labels and trademarks, reached by other ways a thoroughly common sense and practical conclusion. The acquiescence of the Commissioner in the spirit of the decision was full and complete.

Less than a year ago a new Commissioner of Patents was appointed. At first he followed the revised practice of his predecessor, but recently, in the face of the decision of the Supreme Court, he has returned to the old practice, and exercising his powers of judgment attempts to discriminate between labels and trade marks. No court in this country is in better repute than the Supreme Court of the District of Columbia. It is the great court of appeal from the decisions of the Commissioner, and its decisions would seem to be particularly binding upon his actions. Yet his new rulings are directly in the face of and contrary to the decision of November 30, 1881, and he apparently wishes to have a decision from a higher tribunal before changing his views.

Leaving for the present the relations existing between the Commissioner and the Supreme Court of the District, we may glance at the hardship inflicted by this course upon applicants for registration of trademarks. On application a fee must first be paid, which fee is not returned. If the label is decided not to be registerable as such, the applicant, pocketing his loss, may apply for trademark registration, paying another and larger fee. Here too he may be ruled out, when he is left without any way of recovering his fees, and without any equivalent being awarded him for them.

Rulings that lead to this result are wrong. The Commissioner has no responsibility in the matter if he will follow the voice of the court, his direct superior. But of his own volition he has taken the responsibility of departing therefrom, and has chosen to inflict this petty hardship upon many who are ill able to afford it.

Car Couplers.

According to a statement made before the Master Car Builders' Association, there are now in use in this country 800,000 freight cars, and the average annual expense for links and pins for each car is $1.50, or a total of $1,200,000. It is evident that a self-acting car coupler, so made as to prevent the maiming, loss of life, and expense of the common link and pin system, would be an invention of enormous value. Many hundreds of patents have been taken for improved car couplers, but the railway companies, for one reason or another, are shy about introducing them. In Massachusetts a law has been passed compelling all railway companies in that State to put self-acting couplers on their cars on or before 1885. If other States would adopt compulsory laws on the subject, the introduction of improved couplers would soon become general.

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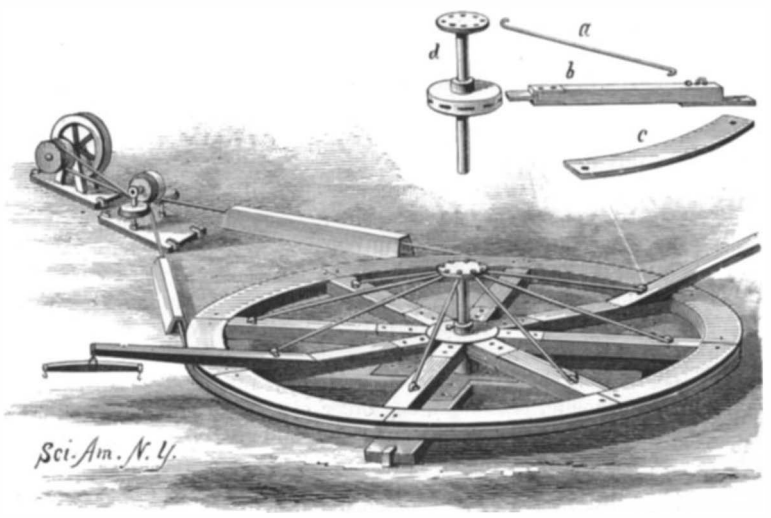
HORSE POWER.

The bed frame or foundation consists of two strong planks crossed at the middle and boxed together: and secured by re-enforcing plates of metal bolted on. The frame is held in position by driving a pointed stake, projecting from the under side of the frame, into the ground; hook headed stakes are placed at the ends of the planks for additional security. In the upper end of the center stake is a deep socket for receiving the vertical spindle that forms the axial support on which the main driving drum revolves. The drum is constructed in sections, in order to be taken apart for ready handling and removal. The cast metal hub is provided with a collar and set screws for fastening it to the spindle, and is formed with sockets for receiving the tenons of the inner ends of the spokes, *b*. On the outer end of the spoke is attached a flat plate which projects beyond the end to receive the ends of the wood fellies, *c*, which abut together on the plates and against the ends of the spokes, where they are detachably fastened by key bolts. On top of the spindle is a disk for staying the spokes and rim by the tension rods, *a;* the rods hook detachably in eye studs placed near the outer ends of the spokes.

The drum thus constructed is grooved in the periphery for working an endless wire to drive a countershaft and pulley, and has one or more sweeps attached for hitching on the horses for turning it. The countershaft to which the rope gives motion by a small pulley is mounted on a bed plate that is staked to the ground by hook headed spikes, and the rope runs between two pairs of grooved faced bevel guide pulleys. These pulleys make a guiding and tightening device, by which the two members of the rope are converged so as to run properly on the driven pulley; when they are shifted toward the driving drum, the rope is tightened as required. In the path of the horses the rope is covered with A-shaped guards.

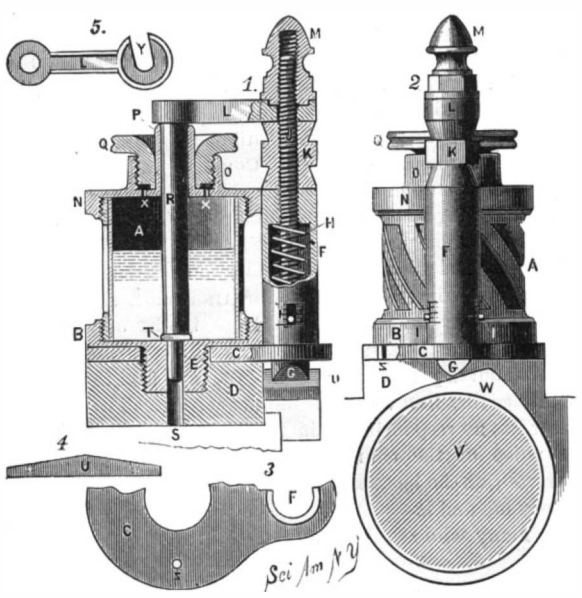
This invention, which can be easily adapted for running corn shellers, feed mills, wood saws, pumps, churns, and other farm machinery, has been patented by Mr. R. F. Rasmussen, of New Albuquerque, New Mexico.



RASMUSSEN'S HORSE POWER.

IMPROVED OIL CUP.

The engraving shows an oil cup designed for locomotives and marine engines, which consumes a minimum quantity of oil, permits no oil to escape when the machinery is not in motion, feeds faster as the speed increases, and which can be filled without interfering with the regulator of feeder. The oil cup, A, is screwed on a plate provided with a neck, E, screwed into the guide, D, and through the plate, C (Fig. 3), which is formed with a tubular standard, F, through which loosely passes a spindle, J, at whose lower end is a beveled projection, G. Surrounding the spindle is a spiral spring pressing it downward. The spindle is guided by a transverse pin passing into vertical slots in the sides of the standard. On that part of the spindle projecting from the standard is screwed the nut, K, upon which an arm, L (Fig. 5), is held by an ornamental nut, M. The arm is provided with a recess for receiving the nut, and with a slit, Y, to allow the spindle to pass into the end of the arm. The cover, N, is formed with an upwardly projecting neck and



IRVINE'S IMPROVED OIL CUP.

with a concentric internally threaded neck, O, between which the filling funnel, Q, is screwed. In the cover between the necks is a series of apertures, *x*. Secured to the arm, L, is the spindle, R, in the lower end of which is a pin fitting in an aperture extending through the neck, E. If a reciprocating piece of machinery is to be oiled, a beveled block, U, is fixed so as to act on the beveled projection of the spindle. If a revolving shaft is to be oiled, a cam projection, W, is arranged so as to force the spindle upward at each revolution.

Every time the spindle, J, is raised, the spindle, R, is also raised, and a small quantity of oil is allowed to pass through the hole, S, to the moving part. By means of the nuts the spindles can be regulated so as to feed any quantity of oil. Marked on the standard is a gauge that shows the stroke of the spindle. By partly unscrewing the funnel, oil can find its way to the cup through the holes, *x*. A full set of these oil cups, used for fifteen months on an engine on the C. N. O. & T. P. Railway, has given entire satisfaction.

This invention has been patented by Mr. J. J. Irvine, and further information will be furnished by Messrs. J. J. Irvine and Bro., of 108 William Street, Chattanooga, Tenn.

Tale Weight of Currency and Bills.

A corresponden t having asked of us how many bills, $1, $5, etc., it took to make one pound avoirdupois, also how many of the different pieces of our metallic currency to make the same weight, we referred the inquiry to Hon. Thomas C. Acton, U. S. Assistant Treasurer at New York, who kindly furnishes us with the following:

"Four hundred and fifteen new one dollar U. S. notes, from actual test, are equivalent in weight to one pound avoirdupois, and the number of notes should be the same of any denomination. It is not, however, perfectly reliable, as the paper upon which the notes are printed often varies in thickness to the extent of one hundred notes in a package of one thousand.

"One pound avoirdupois contains seven thousand grains; thus, by ascertaining the weight of each coin it is a simple computation to arrive at the number of pieces to the pound.

"As the legal tolerance at the mint of one and a half grains upon each silver piece must be taken into consideration, I have caused one pound avoirdupois of each denomination to be weighed, and you have the result in valuation by tale as follows, viz.:

"1 pound avoirdupois,	1 cent pieces		=	$1.43 +	new.
"	"	2	"	(discontinued).	1.46 —	"
"	"	3	"	.....	7 32	old.
"	"	5	"	.....	4.60	new.
"	"	10	"	silver.....	18.10	"
"	"	25		"	18.10	"
"	"	50		"	18.10	"
"	"	$ standard,		"	17.00	"

Novel Plan for Producing Diamonds.

To transmute the baser form of carbon into the priceless diamond has been the dream of alchemists for ages. The latest enthusiast in this field has gone to the trouble of erecting quite an extensive apparatus, by which, with the help of a force of nature, in the manifestation of a flash of lightning, he hopes to attain some tangible result. The experimenter, who is a correspondent of *English Mechanics*, described his device as follows in a recent issue of that publication: "If a source of heat could be obtained of sufficient intensity to liquefy carbon or charcoal," he asks, "would it on cooling assume the same crystallized form as glass? The question is, How can a heat be obtained some thousand times greater than can be produced by any quantity of galvanic cells or dynamo machines? I propose to utilize a flash of lightning in the following manner: I have erected in my garden a long iron conductor attached to a wooden spar firmly fixed in the ground, and three wide ropes as stays. This is about forty feet high, and the conductor extends twenty feet above it. On the top of the conductor is fixed a copper ball eight inches in diameter; the rod is attached to the spar by iron clasps insulated with gutta-percha. The rod is bent about two feet from the ground, leading into a wooden box containing a tube of biscuit earthenware, and about one inch inside diameter and one foot long. The end of the rod is connected to a piece of copper wire ½ inch thick, and passes about one inch into the end of the tubes. The other end has a rod connected the same way, and passes down into the earth. The tube is filled with charcoal or any other carbon. Mr. Swan (of electric light celebrity) suggested lamp black; but this or any other conducting material could be inserted. An earthenware tube I consider preferable to glass, for if an explosion took place, which probably it would, the effects on the carbon could be better seen than among broken glass. I have never yet been fortunate enough to have the conductor struck, as thunder-storms are not very frequent in this neighborhood."

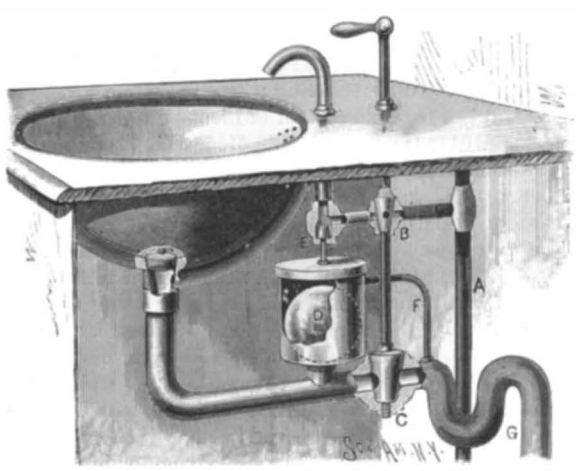
Relations of Sulphurous Acid to the Blood.

Von Ogata has studied this subject in concluding an earlier investigation, and states that the poisonous effects of the free acid rest principally upon the rapid change of the oxyhæmoglobin, whereby the sulphurous acid passes into sulphuric acid at the expense of the oxygen of the blood. Air which held a measured amount of sulphurous acid was conducted through two equal quantities of distilled water and diluted blood. After two liters of air had passed through the water, it (the air) smelt strongly of sulphurous acid, and the water had absorbed a large amount of the gas; the air conducted through blood was, however, without any odor after 8 liters of it had passed through the blood, and the blood itself contained no trace of sulphurous acid, but a corresponding amount of sulphuric acid. An equal mixture of air and sulphurous acid was confined in a receptacle over quicksilver, and the blood, conducted through this, fully absorbed the sulphurous acid. One drop of this blood was added to ten drops of water for spectroscopic examination. The fluid was not red but weakly yellow, and showed in the spectroscope no absorption bands. The instantaneous bleaching of diluted blood by a trace of sulphurous acid was taken advantage of to detect this acid, and it was possible for him with blood in this manner to detect the 0·01 milligramme of sulphurous acid in water. Sulphites do not discolor the blood, not even when acetic or carbonic acid is added. Only by the addition of a strong mineral acid as sulphuric does decoloration ensue. The sulphurous acid works in the organism as well upon the mucous membrane of the air passages and eyes as by disorganization of the oxyhæmoglobin of the blood. The essential cause, however, of death appears to rest in the effects upon the blood, and the gas appears to be a powerful blood poison, as 0·3 per cent in air proved fatal to a number of animals that breathed the mixture for some hours.

COMPOUND AND SELF-ACTING PLUG VALVE FOR WASH BASINS.

The object of the invention herewith illustrated is to prevent the willful waste of water, the overflowing of the basin, and the escape of sewer gas—three very essential points. The inlet pipe has a plug valve, B, to control in a general way the flow of water to the basin, and the discharge pipe has a plug valve, C, to control the flow from the basin. These valves are turned simultaneously by a bar worked by a suitable handle, and their apertures are at right angles with each other, so that one valve will be closed when the other is opened, opening into the discharge pipe is a chamber fitted with a float valve, D, having a stem passing freely through the fixed head of the chamber. Carried at the upper end of the stem is a valve, E, which takes its seat in a casing fitted in a pipe between the valve, B, and the nozzle of the supply pipe. This valve has sufficient play in its casing to leave the passage in the pipe unobstructed and to rise to cut off the flow of water. The small pipe, F, opens into the upper part of the chamber and into the discharge pipe between the valve and trap.

The operation will be readily understood. When the valve, B, in the service pipe is open, the valve, C, in the sewer pipe is closed; the running water then lodges at the valve, C, backs up into the flood chamber, raises the float, D, which controls the valve, E, thereby shutting off the supply of water, at the same time forming an additional



FORD'S COMPOUND AND SELF-ACTING PLUG VALVE FOR WASH BASINS.

water seal or trap, in front of the valve, C, which, the inventor claims, absolutely prevents the escape of sewer gas. As will be quickly perceived, this seal cannot be siphoned out.

Additional information regarding this invention may be obtained by addressing the patentee, Mr. Thomas P. Ford, Jr., 263 Eckford Street, Greenpoint, Brooklyn, N. Y.

Remedy for Rhus Poisoning.

Fluid extract of serpentaria has been used with remarkable success. It is best applied by placing cloths moistened with the extract upon the affected parts, without any friction. Two or three applications generally effect a cure.

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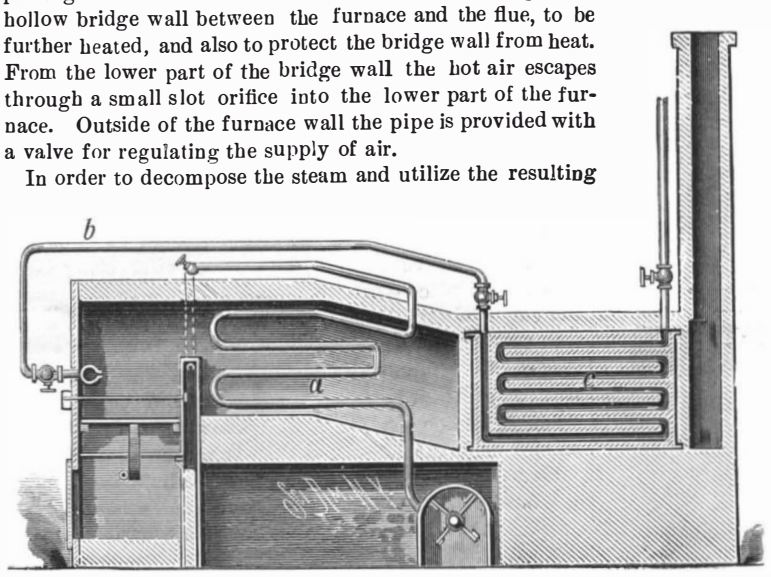
METALLURGIC FURNACE.

Our engraving shows a furnace recently patented by Mr. T. J. Wilson, of 87 Wall Street, Auburn, N. Y., which is designed for heating or reheating blanks. In the left of the cut is shown the furnace, in which coal may be burned on a grate, or a gas burner may be substituted. The hot blast apparatus consists of a fan and the coil of heating pipe, *a*, which is arranged in the flue to be heated by the heat of the furnace passing along it, and which has a discharge pipe passing outside of the wall of the flue and discharging into a hollow bridge wall between the furnace and the flue, to be further heated, and also to protect the bridge wall from heat. From the lower part of the bridge wall the hot air escapes through a small slot orifice into the lower part of the furnace. Outside of the furnace wall the pipe is provided with a valve for regulating the supply of air.

In order to decompose the steam and utilize the resulting



WILSON'S METALLURGIC FURNACE.

gases for fuel, there is arranged a superheating coil of fire clay (called by the inventor a "decomposer"), consisting of a series of horizontal communicating flues, *c*. This coil is placed next to the chimney and is in a fire clay lined metallic case, which has an exterior protecting jacket of similar material. The decomposer is arranged in the center of the flue, so that it will be acted on at both sides and ends by the heat passing along the flue.

The steam enters the decomposer by the pipe shown beside the chimney, and which is connected with the boiler and is furnished with a valve for regulating the supply. In the pipe, *b*, are two other valves, one where the superheated steam leaves the decomposer and the other near where the pipe enters the furnace chamber. By the first mentioned valve the steam may be retained in the decomposer until properly decomposed, and by the other the supply to the furnace may be governed. The steam is discharged into the furnace through numerous jet orifices of a pipe extending from side to side.

Here the oxygen of the steam, uniting with the carbon of the incandescent coal, forms carbonic oxide, leaving the hydrogen free to burn with great intensity in combination with the oxygen of the incoming hot blast. The carbonic oxide, at the same time taking up additional oxygen from the hot blast, burns with great intensity. These changes produce greater heat than the coal alone is capable of. The blanks to be heated are inserted through openings in the chamber above the fire bed. For discharging the ashes without wasting the whole of the fire bed, a temporary grate consisting of bars is shoved in through the front wall and the fire bed into recesses in the bridge wall, whereon the upper portion of the fire will be supported while the rest may be discharged through the lower grate.

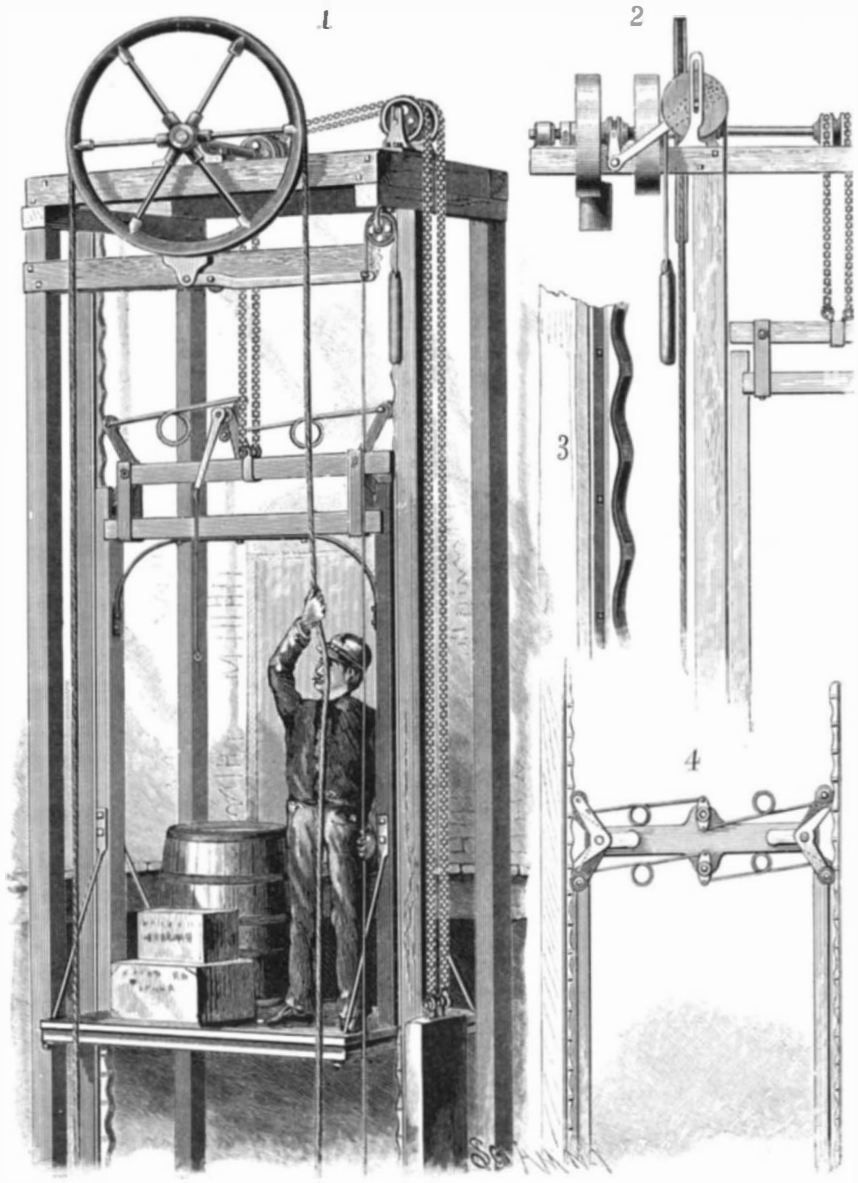
IMPROVED ELEVATOR.

Our engraving shows an elevator provided with safety appliances which are simple in construction, effective in operation, and which combine cheapness, strength, and durability. In Fig. 4 is shown a device for stopping the platform in the upward as well as the downward course, this being necessary, since some platforms are counterbalanced more than the weight of the empty platform, and are liable to damage by ascending rapidly in case they become accidentally disconnected from the motor. In Fig. 1 the device is arranged so as to only prevent the too rapid descent of the platform.

The racks for the ways in which the platform works are made with zigzag side flanges, and cross bars with which catch pawls engage when safety demands the stopping of the platform; the flanges confine the pawls laterally when thrust in the rack. The pawls are provided with arms that balance them away from the rack, and have rolls gravitating to contact with the zigzag ways, so that when the speed is not too fast the pawls will not engage the racks. But should the speed overrun the predetermined limit by the breaking of the chains, so that the thrusts of the projections of the ways would be greater on the rolls, or simply preventing the rolls from following in the bottom of the zigzags, then the pawls would come in contact with the cross bars, thereby holding the car. The roll arms of those pawls which stop the descent of the platform are merely made heavier than the pawls; but those in which the roll arms extend downward are provided with counterbalance weights. When the pawls catch on the racks the thrust tends to keep them in contact, so that in case they only catch slightly at first they will be forced into the bottom of the racks and securely engaged by the momentum of the platform. The pawls of the opposite sides are connected together by rods and balance levers, in order that both may engage the racks simultaneously. The rods are made elastic by means of coils in them, as rigidity might cause breakage in case one pawl should strike on top of a cross bar and the other in the notch between the bars.

The elevator platform (Fig. 1) is suspended from chains that pass over sprocket wheels mounted upon a cross shaft; the chains then pass over pulleys on top of the frame, and thence down to the counterbalance weight. Upon one end of the shaft is mounted a large grooved wheel, in which runs an endless rope which hangs down beside the car within easy reach of the operator. Pivoted to a cross bar near the under side of the wheel is a brake lever, the shoe of which presses against the periphery of the wheel. To the other end of the lever two ropes are attached; one of which passes over a grooved pulley and thence to a weight which acts to keep the shoe away from the wheel; the other passes down beside the platform, so that by pulling upon it the car may be stopped at any point.

Fig. 2 shows an arrangement in which power takes the place of the hand rope. A friction clutch placed between two pulleys mounted on the end of the shaft is operated by a rope passing down the well. This construction is shown plainly in the engraving. These devices have been patented by Mr. Volney W. Mason, and are now being manufactured by Volney W. Mason & Co., of Providence, R. I.

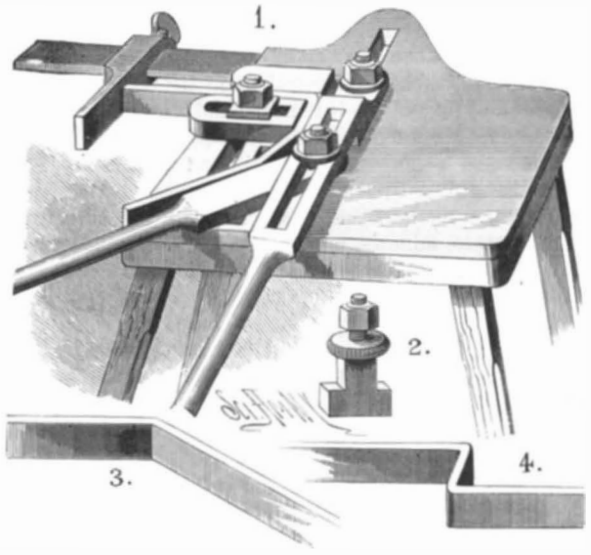


MASON'S IMPROVED ELEVATOR.

A YOUNG INVENTOR.— A California subscriber writes us of a 16-year old inventor, Master Edgar B. Badlam, who has patented an "improved steam boiler," and is perfecting other inventions which promise to be of importance. He has a model shop, costing $2,000, where he has turned out many models, his father thinking that "this is the kind of encouragement the young men of our day should have, keeping them off the streets and making self-supporting men and good citizens."

BENDING MACHINE.

An invention recently patented by Mr. W. W. Stokes, P. O. Box 160, Anna, Illinois, consists of a device for the use of blacksmiths, carriage makers, and other iron workers, for bending stirrup, clip, and other irons by hand. The bed plate is constructed with three parallel slots, and is provided with an anvil block and a gauge bar, both of which are firmly attached; the gauge bar has a shifting stop for gauging the distance of the bends from the ends of the



STOKES' BENDING MACHINE.

bars. Alongside of the anvil block is a former block, having one square end and one half-round end, secured with a bolt, nut, and washer, so as to bind it fast to the bed plate either parallel with, or obliquely to, the anvil block.

The washer is constructed with a rib as wide as the slot to prevent it from turning with the nut. Forms of different forms and sizes are employed according to the different forms and sizes of bars and the bends to be made in them. When the nut is removed, a keeper prevents the bolt from dropping out. In the outside slot is fitted a pivot bolt for the fulcrum of the main bending lever, the bolt being adjustable along the slot for locating the lever as desired relatively to the anvil, and having a sleeve on the part whereon the lever turns for the nut to jam on in securing the lever, and also for sustaining the wear. At a short distance from the pivot bolt the lever is recessed in the lower side to receive the forming block (Fig. 2), and a second lever between it and the bed plate, and it is formed with a longitudinal slot for inserting the bolts of the block and of the second lever. The forming block is to be set close to the end of the second lever when the latter is set at a distance from the recess shoulder and is used for bending a bar around the former. This former is more particularly employed when a reverse angle is to be made, as indicated in Fig. 4. When the bar is to be bent in the form of a clip (Fig. 1), or into an obtuse angle (Fig. 3), the former is not used.

When the machine is arranged as shown in Fig. 1, the first lever bends the bar around to the end of the former, and then the second lever bends it around to the side of the former for making clips.

Manganese in Animals and Plants.

Recent researches by M. Maumene have shown that the metal manganese exists in wheat, rice, and a great variety of vegetables. Wheat contains from one five-thousandth to one fifteen-thousandth of its weight of the metal, which exists chiefly as a salt of an organic acid. It is also found in potatoes, beetroot, carrots, beans, peas, asparagus, apples, grapes, and so on. The leaves of the young vine are very rich in it; so are the stones of apricots. The proportion in cacao is very great, as it is in coffee, tobacco, and especially tea. In the 50 grammes of ashes left by a kilogramme of tea, there was found 5 grains of metallic manganese. There are vegetables, however, in which no manganese can be found, as, for example, oranges, lemons, onions, etc. Many medicinal plants contain it, as, for example, cinchona, white mustard, and the lichen (*Rocella tinctoria*). Animal blood does not always contain it, but it is found in milk, bones, and even hair. M. Maumene regards its presence in the human body as an accident, and not of vital importance. He also suggests that doctors should cease to employ manganese as a succedaneum for iron, for while the latter is useful to the blood, the former is an intruder which is only tolerated in small traces, and rejected in larger quantities. Tea, coffee, and other vegetables require abundance of manganese in the soil for their proper cultivation, and the absence of it may account for the failure of many plantations.

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Bleaching Tallow.

The Oil, Paint and Drug Reporter recommends the following as the best process known to it for bleaching tallow.

About 50 lb. of caustic soda lye are placed into a clean boiler and the steam is turned on. Salt is then added to the lye until it shows 25–28 deg. B. The fat—300 lb.—is now placed in the boiler, and the steam is turned on until the mass is brought to a boil, when the steam is shut off to prevent overflowing. It is allowed to boil up 1–2 inches at the most, and then left to itself for 3–5 hours, so that the fat will clarify. At the end of this time, the upper saponified layer is ladled off; the pure tallow is removed and passed through a hair sieve or linen into a clean vessel, until the lower saponified layer is reached. The residue in the boiler, consisting of sponified fat and lye, is removed and used in the preparation of curd soap, together with the upper layer.

The kettle is thoroughly cleansed, and about 30–35 pounds of water with ¾–1 pound of alum are heated to boiling. To this solution the fat is added, and the mass is allowed to boil for about 15 minutes, until all the filth has disappeared from the fat. The mass is then transferred to another vessel, and left by itself for 3–5 hours.

The pure fat is then again placed into the boiler and heated to boiling, until it shows a temperature of 170–200 deg. C In this last operation the fat becomes snow-white. The steam must be turned off as soon as the slightest trace of vapor of a disagreeable odor is thrown off. The fat may then be directly used or left to cool.

As has already been stated, the steam must be turned off or the fire removed as soon as a trace of disagreeable vapors becomes visible, whether the temperature be 150 deg. C. or 170 deg. C., for if this is not done the fat will again turn dark.

Freshly rendered, sweet fat (not acid or rancid) is most readily bleached, and may be heated quite high. Still the fat used should not be too fresh, or one will take the risk of saponifying the 300 lb. without leaving any to bleach.

Tallow which has been treated in this way, when used in toilet soaps, gives them a white color and agreeable odor. It is also well adapted for candle making, as it becomes exceedingly hard.

Banana Peel as a Lubricator.

A long yellow ice cart, heavily laden, slid the other day into a gutter in Chambers Street, near West Broadway. The rear wheel stuck firmly against the curb. The driver lashed his horses and swung them around, but to no purpose. Ingenious philanthropists offered all kinds of suggestions, patted the trembling, sweating horses, and some put their shoulders to the side of the truck, but without avail. The off rear wheel would not turn. A barefooted little colored boy had watched the proceedings with a child-like look of sympathy for the overstrained animals. He suddenly ran down Chambers Street and returned panting, carrying in his arms a lot of banana peels.

"Say, boss," he called to the driver, "I'll make yer wheel turn with these 'ere, if yer'll let me put 'em down."

"All right, sonny," said the driver.

The little darky sprang under the wheels, and carefully laid down the skins. He pressed some close to the curb, where the wheel was jammed. Then he sprang back and shouted, "Now, boss; pull away."

The crowd laughed; the driver pulled taut his lines and gave his horses a lash. The animals sprang forward, the wheel glided along the layer of banana peels, and the heavy wagon rolled out of the gutter. The onlookers cheered as it drove away.

"Oh," said the little darky, "I've seen pop move barrels and big boxes with oil, and pop tole me a little oil makes hebby dings go round. I seen hebby men fall on banana peel, and I guessed dey'd move dat wheel. My name, boss, am Abraham Lincoln George Brown."—*N. Y. Sun.*

Consumption.

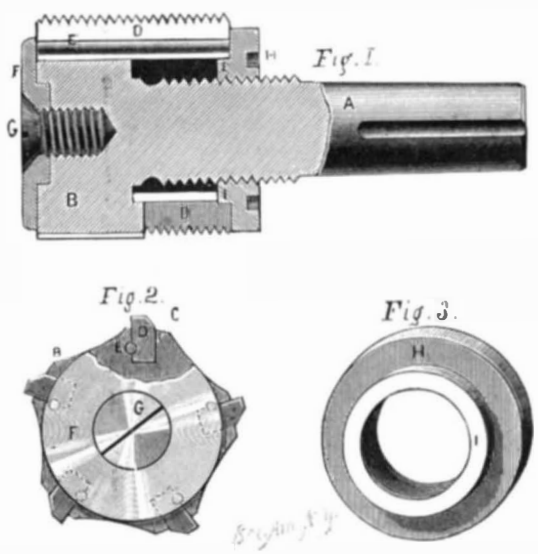
Dr. Edgar Holden, Medical Director of Mutual Benefit Life Insurance Company, Newark, N. J., says: For many years, even among the best informed, the impression has prevailed that consumption exhibits a preference as regards development, for certain ages. Thus, it has been the conviction that those who escape the marasmus and tubercular meningitis of infancy come again into danger at puberty, and that again between thirty-two and thirty-eight a climacteric is reached at which the mortality acquires its maximum of intensity, then diminishing, to declare a wholesale sweep between sixty and sixty-five.

These views have grown out of an experience apparently well founded, since the mortality in every physician's personal field of observation has seemed to be greatest at those periods, but the conclusion is nevertheless a fallacy, and it has been made broader and deeper by statistics of mortality in which the ratio of deaths from consumption to the total number of deaths has been relied upon.

Rare facilities for prosecuting an investigation to obtain a correct result have led me with considerable labor to a conclusion as startling as I trust it will be found conclusive, namely, that death from consumption, instead of being, as is almost universally supposed, most prevalent in early adult life in this country, is in reality not so, but grows relatively more frequent as life advances. This is true in the community at large, and among selected lives is actually less at the ages hitherto deemed most susceptible.

SCREW TAP.

The stock, A, is formed with a head, B, provided in its rim with a series of longitudinal grooves, C, that receive the cutters, D, the outer ends of which are held flush with the end of the head. The grooves, C, are formed with side grooves, E, and the corresponding surfaces of the cutters are similarly grooved. The cutters are prevented from being lifted out of the grooves by locking wires which are passed into the aperture formed by the two small grooves. A disk, F, held on the end of the head by a screw, partly overlaps the outer ends of the cutters and prevents them sliding out of the grooves. Mounted on the screw threaded portion of the stock is a nut, H, formed with an annular ridge, I, on which the inner ends of the cutters rest. The cutting teeth at the front ends of the cutters wear off more rapidly than the rear parts, and if they become too dull to cut, the disk



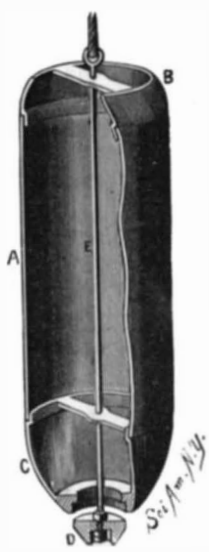
EDDY'S SCREW TAP.

is removed, and the cutters are moved forward to project from the head by turning the nut; the ends of the cutters are then ground off flush with the end of the head.

This invention has been patented by Mr. H. W. Eddy, whose address is corner Euclyd and Waite Avenues, Toledo, Ohio.

WELL BUCKET.

An invention recently patented by Mr. R. H. Foat, of Weatherford, Texas, is illustrated in the accompanying engraving. The top ring of the bucket has a cross bar having a central aperture, through which the valve rod passes. The lower edge of the ring is formed with an annular rabbet for receiving the upper edge of the cylindrical casing, A, that is made of sheet iron. The lower edge of this casing rests in a rabbet made at the upper edge of a cup, C, forming the bottom of the bucket. In the bottom of the cup is an aperture, in the edge of which is formed a rabbet for receiving the edge of the valve, D, held by nuts on the lower end of the valve rod. At the top of the cup is an apertured bar through which the valve rod passes.



FOAT'S WELL BUCKET.

The upper ring, B, the cup, and the valve are made of malleable iron. The rope is attached to an eye formed at the upper end of the valve rod. By this means a simple, strong, and durable bucket is constructed.

Destruction of Fish by Dynamite.

Thousands of dead fish have been floating down Niagara River of late; among them have been large sturgeon, handsome muscalonge, black bass, and cat fish. On the beach, also, from Bay View to Dunkirk, the dead bodies of fish have been washed ashore. All appeared to have died within a short time. This wanton destruction is believed to have been caused by a party of reckless young men who sailed about in a steam yacht and now and then lowered into the water dynamite cartridges, which were exploded by electricity.

Rattle Snake Bite.

Perhaps there is no place on this continent where rattle snakes do congregate in greater numbers than along the Tioga River, in Pennsylvania. The mountains through which that crooked stream finds a passage are the home of the rattle snake, and in the warm summer months they leave their dens by thousands for the narrow valley, where they bask in the sun for a few weeks, and those that do not get their heads bruised by the heel of man, or get cut in pieces by lying nights on the warm rails of the Corning and Blossburg railroad, as thousands of them are, crawl back to their dens in the rocky ledges. In midsummer it is an almost daily occurrence for some one to be bitten by these reptiles in the Tioga Valley, and domestic animals are frequently bitten. But the residents of this region do not look upon the bite of these reptiles as anything serious. When a person is bitten, a handful of mud or wet clay is applied to the wound, and fresh applications are made every ten or fifteen minutes until the poison is all drawn out. The first thing a native of that locality does after being bitten is to seek a place where hogs wallow, where soft mud or wet clay is always found. He binds on a quantity, and is soon cured. The same is applied to domestic animals when they exhibit symptoms of snake bite, and this treatment is always successful if the application is made before the poison has gone too far. It is well known that hogs are not harmed by snake bites, and this is accounted for by the porkers' habit of cooling off by lying in a mud hole.

A farmer on the line of the Corning and Blossburg railroad had a small cur dog that made it his business to kill rattle snakes. In his encounters with large ones he would be bitten several times, but as soon as the fight was over he would hasten to the farm yard and lay himself in a "hog wallow" for several hours, when he would come out entirely free from poison.

It is well to fortify the system with stimulants, then apply the clay mud, and a cure is certain. The clay must be moist, or of the consistency of dough.

WM. S. HUNTINGTON.

We are inclined to think that the snakes referred to by our correspondent were of a different breed, or age, or condition from some of those whose bite is fatal. On the 13th inst., in this city, James Reilly, a snake charmer, who was exhibiting rattle snakes, and had taken one of them out of its box, according to custom, was bitten in the right hand by the reptile. The man returned the snake to the box, and began at once to suck the poison from the wound with his mouth, then swallowed a quart of whisky and went to the hospital. Here he was treated with hypodermic injections of whisky and sedatives; other remedies were also tried, but it was of no avail. After lingering for over twenty-four hours in agony, the unfortunate man died. Reilly himself declared his belief that the bite of that particular kind of rattle snake—diamond back—was always fatal.

A few hours before Reilly died a Westchester County farmer named Purdy appeared, bringing what he claimed to be a sure cure, as it had saved the lives of at least fifty persons. He was allowed to try the remedy upon the sick man. It consisted of a decoction of herbs. The only effect was to produce a short sleep.

New Apparatus for the Relief of Deafness.

Professor Politzer describes in the *Wiener Medizinische Wochenschrift* a little instrument invented by himself to aid those whose power of hearing is impaired. The principle is to transmit the vibrations from the pinna to the membrana tympani. Politzer opposes Voltolini's opinion that the cartilage of the ear is a poor conductor of sound, and on the contrary believes that the pinna, by means of its vibrations, is of great importance in the mechanism of hearing. His apparatus consists of a small elastic drainage tube, one end of which is beveled off so as to rest evenly against the drum membrane, while the other end is curved slightly, and by its elasticity presses gently against the anti-helix. Near its outer extremity the tube is attached to a small concavo-convex rubber plate. This plate is fitted so that its concave side lies in apposition with the concavity of the concha. The idea of this attachment is to increase the conducting power of the instrument and to transmit with greater facility the vibrations of the pinna. In a large number of experiments made to test the value of this instrument, the inventor found that in most cases the hearing distance for the voice was considerably increased, in some instances from two feet without to fifteen or twenty feet with the apparatus. In many cases the hearing distance for the watch was also increased, though in no such striking degree as that for the voice. In cases in which the drum membrane was partially or entirely destroyed, it was found necessary to attach an artificial drum to the inner extremity of the tube. In deafness due to anchylosis of the ossicles or to disease of the labyrinth, little or no improvement was obtained by the employment of the tube.

Crushed Ice for Burns.

The value of crushed ice as a dressing for burns and scalds, first pointed out by Sir James Earle, is confirmed by Dr. Richardson (*Asclepiad*, 164). The ice, after being reduced by crushing or scraping to a fine state of division as dry as possible, is mixed with fresh lard into a paste, which is placed in a thin cambric bag and laid upon the burn. This is said to banish all pain until the mixture has so far melted that a fresh dressing is necessary.

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Correspondence.

A Steam or Compressed Air Sky Rocket.

To the Editor of the Scientific American:

After reading the account of the singular boiler explosion at Orleans, given, with an engraving, in your number for July 19, it occurs to me there is an excellent opportunity for some ingenious person to invent a steam rocket. If a large steam boiler, standing on wheels in the street, like a steam fire engine boiler, can be made to lift itself over housetops, as shown in your engraving, it would seem not to be a difficult task to construct a steam or compressed air rocket applicable to useful purposes. Let inventors try.

O. B. SERVER.

Contraction of Steel.

To the Editor of the Scientific American:

In your issue of July 12 you give some peculiarities with which mechanics have to contend in the working of steel, that have not received the attention that ought to be given to so important a matter. Some years ago I had occasion to temper many cutters, dies, punches, and other tools, and experienced all the difficulties alluded to in your article. From Edes' "Management of Steel," and another little English book, I obtained many *points*, and by careful working, paying strict attention to heating and the bath, was able to increase or decrease the tool to be tempered at pleasure.

The idea that *steel* is *steel*, and must have similar treatment for all kinds of tools, ought no longer to find advocates. Steel suited for one kind of tool may be totally unfit for another, or require totally different treatment. If makers of tool steel would mark their different brands, and publish a circular giving information of a reliable nature concerning it, a uniformity would soon be reached and recognized among mechanics, and tools would pass for their actual worth according to a known standard of excellence.

LEVI K. FULLER.

Brattleboro, Vt., July 11, 1884.

Happiness and Health.

To the Editor of the Scientific American:

In your paper of April 26, quoting from the *Lancet*, you say: "One-half of the 'dyspeptics' we see would be *well* if they were only *happy*." "Be happy, and your sympathetic ganglia will have the blood coursing through them with the bound of health." "With those who live by rule, and tremble as they live, laboring to eat and drink precisely what 'is good for them' and nothing else, the cause of failure is that such persons are overcareful."

Now, this is so totally a one-sided view that I cannot allow it to stand without a word of protest. While admitting fully that the influence of the mind upon the healthy action of the body is absolutely immeasurable, and while practicing upon this belief daily, I at the same time cannot but also admit and assert that the influence of the body on the mind is a factor equally demanding consideration. The first sentence quoted above reads quite as correctly, "They would be *happy* if they were only *well*." I find very many cases in which, speaking in all moderation, it is so nearly *impossible* for the person to be happy, that we can hope for a return to cheerfulness, and to even a reasonable view of the affairs of life, only by a restoration of comparative soundness in bodily functions.

The perfect blackness of despair, a depth of despondency which nothing can fathom, I have often seen, whose origin was purely and simply an exhaustion of nerve force, showing itself chiefly in that very solar plexus to which your article referred, and thence affecting the two organs with which it is so closely associated, and with such myriad ramifications, the stomach and the liver. The remark often quoted that "it is impossible for any one to be a good Christian whose liver is out of order" has in it a world of practical truth and wisdom. A *cheerful* Christian he may well be excused from being. It is not only useless, but it is a cruel folly, to tell such a one that he must arouse himself to cheerfulness and shake off his gloom. It is true he may try, and I may urge him to make every effort in that direction, but I none the less bend all my energies to restoring the physical force which he has lost. When a patient comes under my charge with a fractured femur, is it right for me to tell him to stand up and walk? I prefer to apply splints, and wait for the fracture to be healed. He will be ready enough to walk as soon as he has strength to do it.

It is in fact utterly out of the question to take any fair view of this matter without taking cognizance of the two sides, both physical and mental, and in almost equal degree; and it must never be forgotten that even where the sole cause of the exhaustion of nerve force may have been mental, there have supervened physical derangements which then become of themselves reacting causes of increased difficulty; and those derangements we can scarcely expect the mind to remove without physical aid and the lapse of time. The blood will not go coursing through the sympathetic ganglia with the bound of health (when those ganglia have lost their proper tone) simply because the patient is happy; and the man who wrote as above that "the cause of failure" in persons who were forced, as the price of even decent comfort, to watch carefully their diet, "is that such persons are overcareful," can scarcely, as it seems to me, have had the responsibility of attempting to restore such a weakened power of digestion to a healthy state. Of course the power of the mind can greatly assist, and the patient can and ought to be taught that he can aid his restoration in a remarkable degree; but that weakened stomach has become as much a positive fact as the fractured femur; one needs splints as surely as the other.

And in this connection we are brought face to face with the fact that we continually encounter a condition of nervous exhaustion which is entirely distinct from simple fatigue, and which cannot be removed by rest alone. It is of itself a *disease*, as distinctly and truly so as is typhoid fever. No organic changes of nerve tissue are manifest, and we call it functional in its nature. Perhaps this is true, and then, again, perhaps there *are* changes too minute for recognition. At any rate, this condition of nerve force affects so powerfully all the functions of the body, but above all others the digestion, that it is responsible for a chief part of the depression to which we have referred; and thorough experience has clearly shown that mind and body must both be regarded and thoroughly studied before any hope of its removal can be entertained. Man's dual nature is not a matter pertaining to the theologian or the psychologist only; it much more closely affects the daily work of every physician in active practice. Man is an animal, but he is something more.

W. O. A.

Microscopic Items.

For a good swab for cleaning small vials, test tubes, etc., use a piece of the round leather belting sold by dealers in sewing machine supplies.

Disinfectants.—What is the best disinfectant? *Answer*—A high degree of cleanliness. There is no disinfectant besides this that is perfect in its action. If not thorough, it is almost useless. Many disinfectants only narcotize disease germs, but do not destroy them.

Method for Double Injections.—The veins are first injected through the arteries with colored gelatine, and then a differently colored plaster of Paris is injected in the same way, forcing the gelatine before it, but as this stops at the capillaries, the arteries and veins can readily be distinguished.

The Beautiful Snow.—From the pure and beautiful snow, just fallen, Floegel has obtained living infusoria and algæ, bacilli, and micrococci, mites, diatoms, and great numbers of fungi spores, also fibers of wood, mouse hairs, pieces of butterfly wings, skin of larvæ of insects, cotton fibers, pieces of grass, epidermis, pollen grains, rye and potato flour, grains of quartz, minute pieces of roofing tiles, and bits of iron and coal.

A Pretty Slide.—A very pretty slide, and one very easily made, is the raphides in the sap of the daffodil. It is only necessary to squeeze out a drop of sap from the flowering stem on to a slide, and on its drying, which may occur spontaneously, or be done over a spirit lamp, we find hundreds of crystals strewn over the field of view. With the polariscope they are exceedingly interesting and brilliant. If we drop over the warmed glass a little Canada balsam, we can press on a cover glass.

Simulation of the Tubercular Bacillus.—The memoirs of A. Celli and C. Guarnieri give the results of a large number of observations on the bacillus described by Koch in the nodules of tuberculosis and in the sputa of consumptive patients, and further call attention to certain crystals found not uncommonly in these sputa, which, both by their appearance and by their behavior toward aniline colors, imitate the tubercular bacilli. The microscopic differences between the two classes of objects are minutely described.

Examining Alive the Heads of Insects, Spiders, etc.—Mr. E. T. Draper recommends a cone of pasted paper to be made rather larger than the specimen, with the apex cut off. A vigorous spider will soon project its head through the aperture. When in this position it should be blocked behind with cotton wool slightly wetted. The cone can then be gummed to a slip, apex upward.

Many insects can be arranged in the same way for the observation of facial movements, and such front views admit of interesting and extended study, the action of the antennæ, palpi, and various organs of the mouth may be watched, and curious effects produced by the excitation of saccharine or nitrogenous juices, administered from the top of a sable pencil.

Bacteria Experiment.—During a recent lecture in the Philadelphia Academy of Pharmacy, glass jars were passed around containing samples of cultivated disease germs Potatoes cut in halves had been lightly smeared with a coating of substances containing germs. The bacteria were nourished on the moist surface of the potato, and presented very interesting appearances. Different results were obtained from different bacteria. Some of the half potatoes were covered with an ordinary deposit of mould. On others the disease germs had developed into thin, peculiarly shaped patches of fungous growth of bright blue, red, yellow, and greenish colors. Others had grown into an intricate and extensive network of fuzzy fibers, the growth on the surfaces of two or three potatoes reaching over and covering a space having a diameter of eight or nine inches.

Tenacity of Tubercle Bacilli.—It has been doubted whether the sputa of tubercular patients, which are thrown on the streets and later mix with all kinds of dust, would ever cause the disease. To determine this question, Dr. Vignal (*Deutsche Mediz. Zeitung*, 1884, No. 1) has collected sputa, as they had been expectorated by phthisical persons in the streets. He mixed them with the common street dirt, moistened them, put them on a porcelain plate, suffered them to dry, again moistened them, again let them dry, and continued these experiments for a very long period of time. Then he made inoculation from these sputa in two Guinea pigs; one died a few days later from a different, accidental complaint, the other first became fat—a proof of the experimenter's good feeding—then slowly emaciated, and finally, three months later, died. The post mortem showed a large number of tubercles, many in the state of caseous degeneration, and a great number of bacilli.

This experiment proves that the sputa collecting in the streets and on the floors of dwellings are by no means innocuous, but serve as pathogenic elements in persons predisposed to this disease.—*The Microscope.*

The Vitiation of Air by Different Illuminants.

The following table, prepared for the *Engineering and Mining Journal*, shows the oxygen consumed, the carbonic acid produced, and the air vitiated by the combustion of certain bodies burnt so as to give the light of twelve standard sperm candles, each candle burning at the rate of 120 grains an hour:

Burnt to give light of 12 candles, equal to 120 grs. per hour.	Cubic feet of oxygen consumed.	Cubic feet of air consumed.	Cubic feet of carbonic acid produced.	Cubic feet of air vitiated.	Heat produced in lb. of water raised 10° F.
Cannel gas	3·30	16·50	2·01	217·50	195·0
Common gas	5·45	17·25	3·21	348·25	278·6
Sperm oil	4·75	23·75	3·33	356·75	233·5
Benzole	4·45	22·30	3·54	376·30	232·6
Paraffine	6·81	34·05	4·50	484·05	361·9
Camphene	6·65	33·25	4·77	510·25	325·1
Sperm candles	7·57	37·85	5·77	614·85	351·7
Wax	8·41	42·05	5·90	632·25	383·1
Stearic	8·82	44·10	6·25	669·10	374·7
Tallow	12·00	60·00	8·73	933·00	305·4
Electric light	none.	none.	none.	none.	13·8

A New Source of Electricity.

As well known, hydrogen is an element of great importance. Possessing little stability, it decomposes in the presence of a large number of bodies, and recombines according to the circumstances under which it is caused to act. One of its best known reactions has led Mr. Bremond, of Paris, to think that its presence in privy vaults might be put to profit in the production of an electric current. In the presence of iron, hydrosulphuric acid decomposes, in fact, and gives rise to the following reaction:

$$2Fe + 3HS = Fe_2S_3 + 3H.$$

Free hydrogen is disengaged; but, if it be brought into the presence of an oxidizing body, such as the sesquioxide of iron, for example, it will at once combine with the oxygen of the oxide, according to this formula:

$$3H + Fe_2O_3 = 2Fe + 2HO.$$

It results from this that if things be so arranged that these two reactions shall occur simultaneously, so to speak, an electric current ought to be engendered.

In order to collect this current, Mr. Bremond would arrange his pile as follows:

In a porous vessel of any shape whatever, he would arrange a cylinder of carbon surrounded with an intimate mixture of sesquioxide of iron and powdered charcoal, the whole being placed in a sort of envelope of iron wire. The connections being made, on the one hand with the interior charcoal, and on the other with the external armature of iron, the element thus constituted would be immersed in the privy vault. It is evident that if the circuit were now closed a current would be produced. This granted, a very large number of elements of this kind might be grouped for tension or quantity in such a way as to obtain a current capable of directly supplying lamps, or at least of charging accumulators.

The idea, as may be seen, is very original and seductive, because of its very simplicity. The porous vessel, moreover, which might prove troublesome on account of its brittleness, is not necessary, since the central carbon might be directly covered with an agglomerate of sesquioxide that could be afterward surrounded with an iron envelope. The iron itself is not absolutely indispensable, for zinc would behave in the same way, and might, if need be, be substituted for it; care being taken, however, to increase the number of elements for the same current, since the reaction would not be so lively with zinc. Finally, the sesquioxide of iron might likewise be replaced by any oxidant whatever, but as it is one of the cheapest of such itself, we scarcely see what could be practically employed in its stead except peroxide of manganese.

Such is Mr. Bremond's ingenious and original idea.—*La Lumiere Electrique.*

Launch of a Great Ship.

The Cunard Line steamer Umbria, the largest vessel afloat excepting the Great Eastern and City of Rome, was launched June 25 from the yard of Messrs. John Elder & Co., Fairfield, Govan, for the Cunard Company. She measures 8,000 tons gross, her length is 520 feet, her breadth 57 feet, and her depth 40 feet. Her engines are designed to indicate 12,500 horse power, the most powerful marine engines yet constructed. She was named the Umbria by the Hon. Mrs. Hope. She is built entirely of steel, is divided into ten water tight compartments, and has five decks. The promenade deck extends for 300 feet over the whole breadth of the vessel, and the saloons will all be proportionately large. It was matter of remark among the company present at the launch that it is less than ten months since the keel of the vessel was laid. The new ship will run between New York and Liverpool.

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CONICAL PRESS FOR TREATING BEET PULP.

Exhausted beet pulp makes an excellent food for cattle, provided that it is neither too moist nor too dry; and, in order to bring it to the proper state for this purpose, Messrs. Selwig & Lange have invented a very ingenious conical press, which is illustrated in the accompanying cuts.

The apparatus is specially designed for expressing the juice contained in beet pulp that has been exhausted through the different processes of extraction. Figs. 1 and 2 represent it in longitudinal and transverse section, and Fig. 3 gives a perspective view of it.

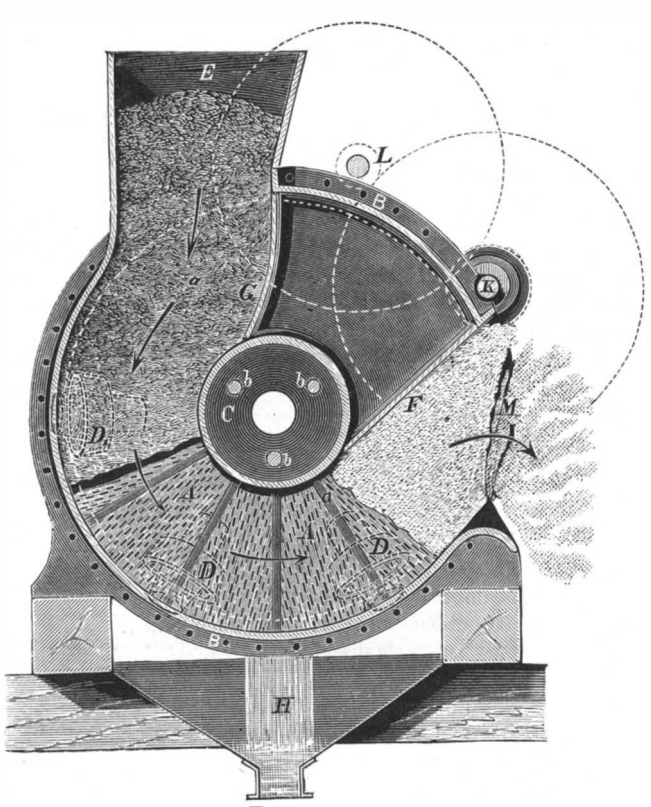

FIG. 1.

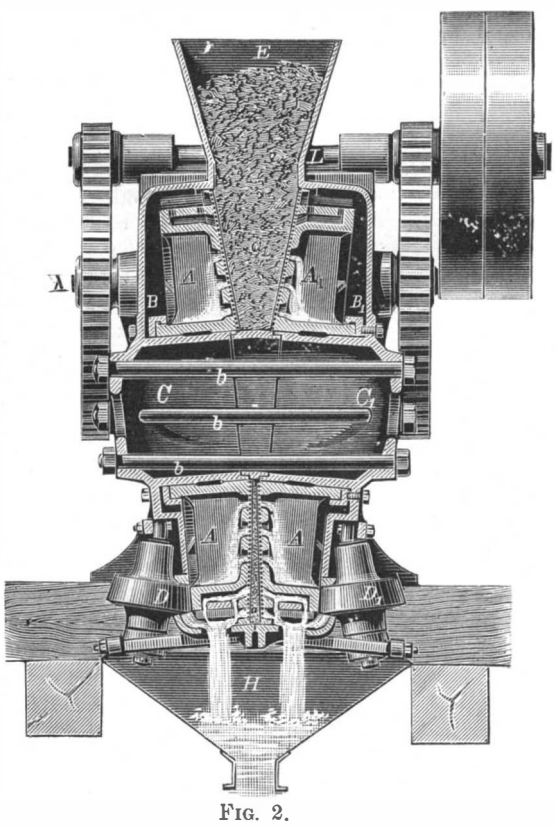

FIG. 2.

PRESS FOR TREATING BEET PULP.

The pulp, which is supplied continuously by a chain and buckets or an endless screw, enters the hopper, E, and falls at *a* between two openwork disks, whose sides are inclined and covered with perforated iron plate. These disks are surrounded by the cheeks of the frame, B B′, and the latter is securely bolted to wooden blocks fixed to the flooring. The disks revolve very slowly, and at an equal rate of speed, around stationary drums, C C′, that are connected by tie rods, *b*, and they form with each other an obtuse angle such as to make them further apart at their upper part, *a′*, than at *a*. The pulp thus fills a chamber whose sides taper downward in the form of a wedge, and moves constantly over inclined axes. Owing to this arrangement it is carried along by the friction of the revolving disks, and is brought progressively into the narrowest interval of the pressure chamber. During this motion it undergoes a strong pressure, which reaches its maximum at *a*, and all the juice that it contains traverses the strainer and the disks, A A′. The liquid afterward escapes through wide orifices in the lower part of the frame, and falls into a funnel, H, which connects with a drain.

As the rotary motion is continuous, the expressed pulp, on making its exit from the space, *a*, passes into a wider cavity, and afterward meets with a partition, F, which forces it to make its exit from the apparatus through the aperture, M, in a state of considerable cohesion.

In order to permit of regulating the pressure, which depends upon the distance apart of the disks, A and A′, the builders have arranged, externally to each of these parts, a sleeve, whose position is determined by screws connected with the frame. Each sleeve is capable of moving upon its axis, C or C′, in such a way as to increase or diminish the interval that exists between the strainers.

As shown in the figures, rotary motion is transmitted to the apparatus by a belt that passes over a pulley keyed to the shaft, L. Two gearings then drive the shaft, K, and this sets in rotation two pinions that gear with a system of toothing upon the circumference of the pressure disks, A and A′.

In order that the motion of these latter may be properly guided, each of them is put in contact with three conical rollers that pivot on the frame and run in bearings that permit of the position of their axes being regulated. All the running parts have to be carefully looked after and kept lubricated with tallow and black lead.

The use of this press in sugar works has demonstrated the fact that it is unnecessary to take out the strainers in order to clean them during one season's running.

This operation, although very easy, may be avoided by forcing in, from time to time, a powerful stream of water against the external surfaces of the disks, which will then preserve all their efficiency.—*Revue Industrielle.*

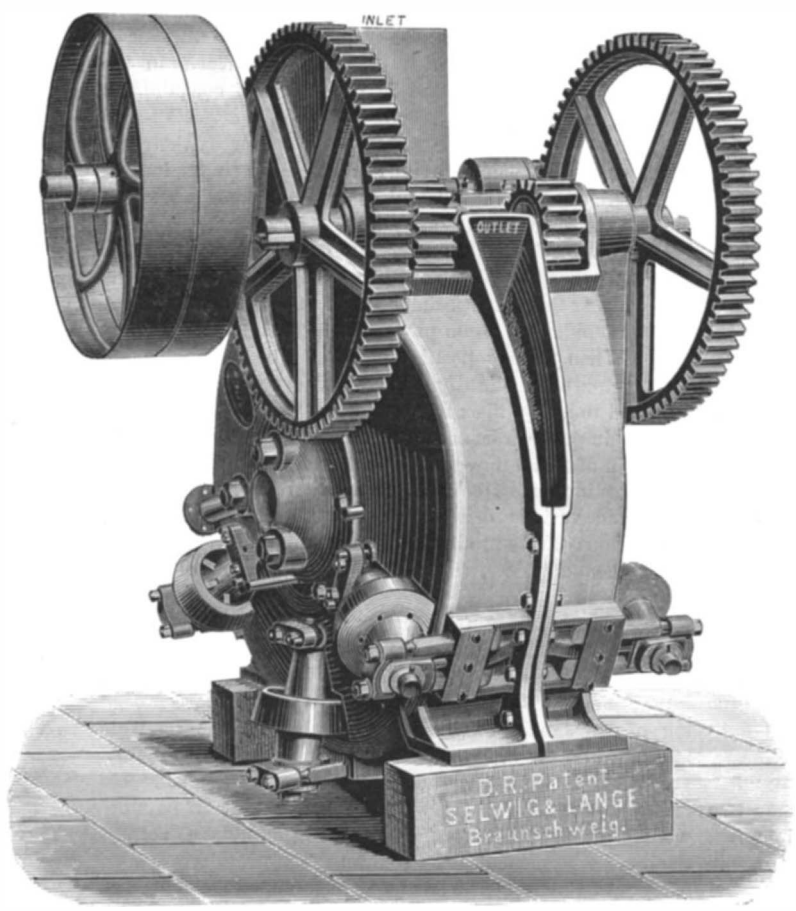

Fig. 3.—PRESS FOR TREATING BEET PULP.

MACKEREL AND ALE.—Notices have been posted outside the various metropolitan hospitals in London, warning the public against the excessive use of mackerel and mild ale at this season of the year, as the larger fish are liable to contain a small worm, which would be injurious and likely to cause cholera and other diseases. The caution with regard to the drinking of large quantities of mild ale is given especially to the working classes. The beverage produces profuse perspiration, and renders the body liable to a chill, which would be likely to lead to serious consequences.

Sand Binding Plants for the Sea Shore.

The English Government, through her representatives at Madras, India, has received a report on the binding of the sands on the sea coasts by planting of indigenous plants to protect the beach and roads from the shifting sands. According to the report furnished the Revenue Department by Doctor Bidie, the planting of such plants was enforced by law on the beaches of Long Island as early as 1758, and in France, where successful and extensive operations have been carried on since 1780. In the south of France the first step toward arresting the progress of the sand is to erect a barrier to the drift, the usual form being composed of palings or boards about 4 feet high, and the sharpened ends driven into the sand. Each board is from 5 to 6 inches wide and 1½ inch thick. An inch space is left between the boards, so that as the sand drifts it is piled up in front of the boards, and passing also through the spaces is deposited behind. The boards soon become buried in the heap of sand which is collected around them, when they are raised without disturbing the heap. When the paling is first erected, a space on the windward side eight times wider than its height is planted with sand binding plants, those used in France being chiefly Arundo arenaria, a Triticum, Cakile maritima, and a Salsola. The dune thus secured rises higher and higher, and the plants as they are buried struggle upward and bind the drifted heap with a network of roots. The dunes in France increase in height at the rate of about a foot a year, and the top is sometimes covered with Tamarisk.

Dr. Bidie says: "The chief local plants instrumental in thus arresting and consolidating sand are, viz., Spinifex squarrosus, Ipomæa pes-capræ, Launæa pinnatifida (formerly Microrhyncus sarmentosus); and to these may be added Cyperus arenaria and other Cyperaceæ, and Tridax procumbens. The locality which these plants frequent is that of the loose, shifting sands. The most common species found in these localities are Canavalia obtusifolia, Hydrophyllax maritima, Sesamma prostratum, Pupalia orbiculata, and Crinum sp.

"Pandanus odoratissimus is particularly useful when it is desirable to raise the sand drift in large heaps, and at the same time to afford shelter from the sea breezes. The Calophyllum inophyllum also thrives well when planted in such situations, and so does Phœnix sylvestris. If there is a backwater or canal, Aviannia tomentosa will be found most useful for consolidating the bank and catching the drift, as a dense miniature thicket of shoots springs up wherever the roots extend, and catches *debris* of all kinds as well as sand. If the water is fresh the tall grass, Saccharum spontaneum, also becomes a most valuable protecting agent from the moving sand. Other trees which thrive well near the coast, and which might be used for planting up reclaimed tracts of sand, are Eugenia jambolana, Albizzia lebbek, Sapindus emarginatus, Thespesia populnea, Paritium tiliaceum, Cordia myxa, Pongamia glabra, Odina Wodier, Mangifera indica, Feronia elephantum, Mimusops hexandra, Dalbergia paniculata, Acacia planifrons, Acacia latrosum, Pithecolobium dulce, Ficus indica, F. tsila, and Casuarina muricata.

"Extensive plantations of this last named tree exist for many miles along the coast north and south of Madras, and these have greatly improved the appearance of what was before a sun beaten, sandy waste. There can be no doubt also that the plantations have rendered the fields behind them more valuable for affording shelter, and in some cases have permitted land to be brought under cultivation which would otherwise have remained in a waste state. The Casuarina is a very hardy plant near the sea, and will grow down to high water mark even among loose sand. The secret of its flourishing in such situations is due to the fact that the subsoil water is always near the surface, and that the sand, although apparently barren, is generally largely mixed with decayed organic matter. When the trees in a Casuarina plantation are left unpruned, they throw out decumbent horizontal branches, which develop roots and thus fix the sand."

Dr. Bidie says that the importance of the Casuarina in the reclamation of waste sandy tracts on the coast can hardly be overesti mated. It is not likely that all the plants which thrive in the hot zone of India will do well in this latitude, but the desirability of protecting the sea shore in many places from shifting sands will no doubt induce some new experiments, with the hope of discovering some plant or shrub which is better suited for staying sand drifts than has been used before on our coasts.

The Orphan's Friend.

On the 9th of July a fine monument was unveiled at New Orleans in the presence of an immense assembly of the people, to the memory of Margaret Haughery, an unlettered Christian woman, who by her energy and industry amassed a competence. Although a devout and fervent Catholic, she knew no creed and recognized no faith in the dispensation of her benevolence. She responded to all worthy calls for assistance, she bestowed most of her bounty on the orphans, and when she died she was known as the orphan's friend. The statue represents Margaret sitting in a chair clasping an orphan to her side, while her hand rests upon the child, who is bending forward, looking up into her face. The pedestal surmounting the base is of Italian marble. The group is also of Italian marble. The entire cost of the decorations for the grand pedestal and statue will be $6,500.

THE value of the fish caught by Canadian fishermen during 1883 is placed at $17,000,000.

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A PRACTICAL METHOD OF ESTIMATING DISTANCES.

Draw one or more silhouettes of standing or kneeling men upon a card—the standing ones 25 mm. in height and the kneeling ones 16 mm. If you are an artist and have the means at disposal, instead of simply blackening the figures you may paint both surfaces with the colors that are peculiar to the different uniforms of the enemy, but care must be taken not to lay the colors on too thin. Now cut the figures out with care, leaving sufficient paper attached to their bases to allow the instrument to be held between the thumb and first finger.

The apparatus being constructed, it only remains to use it: At 200 meters distance station one or more men, and, where you are standing, allow an assistant to hold the instrument at the height you direct him to. Now proceed to a distance of exactly four paces, of 0·75 m. each, from your figures, and ascertain whether their general aspect, as regards height and width, corresponds to that of the men stationed 200 meters off. If the resemblance is perfect, you are in possession of one of the simplest and most portable of telemeters; if it is not, you will have to begin all over again. You may renew the operation by placing your men at 300 meters, and taking six paces instead of four (Fig. 1).

Supposing that the apparatus has been constructed satisfactorily, the manner of using it for estimating distances will be readily understood. Let an assistant hold the instrument in the direction of the troop that serves as an objective, while you move backward in keeping your eye upon the silhouettes and the objective, and stopping when the figures and men exhibit the same aspect and seem to form part of one and the same group. Then returning to your assistant, you count the number of paces that separated your eye from his hand. Upon multiplying this number by 50, you will obtain a product that will give you in meters the distance sought.

Notwithstanding the wonderful simplicity of the instrument, it is easy to control the accuracy of the principle upon which it is based, first, by reasoning, and then by experiment.

In the similar triangles, A B C and D E C (Fig. 3), we have the ratio:

$$(a) \qquad x = l\frac{H}{h}$$

H and h being constants, l will have to vary with x, that is to say, with the distance.

The arrangement adopted permits, on holding the instrument away from the eye, of diminishing the difficulty that the latter has of seeing the objective and image simultaneously. Besides, it lessens the trembling of the hand that holds the apparatus, and which would render observation impossible in an ordinary stadium placed at 0·6 m. from the eye

What is the value of $\frac{H}{h}$? In the majority of proportional base telemeters the distance sought is 50 times greater than the base. Such a ratio is very convenient, since it necessitates a base of only 20 meters for a distance of 1 kilometer. However, as the observer can scarcely measure the base otherwise than by pacing it off, it has seemed preferable, in order to expedite the operation and avoid a conversion of pace measurements into meter ones, to take a mean pace of 0·75 m. as unity, and to modify the formula so as to at once obtain the distance in meters.

In formula a, on substituting $n \times 0{\cdot}75$ for l, and making $\frac{H}{h} \times 0{\cdot}75 = 50$ (H being equal to 1,665), we shall have 0·249 m. as the value of h.

If, however, greater precision were required in the results, the meter might be preserved as the unity of measurement of the base, the silhouettes be given a height of 33 millimeters, and a cord about 30 meters, with knots 1 meter apart, be employed. But it will be readily understood that this process, although more accurate, is much less practical.

Let us now examine the causes of error as well as their limits.

The height of a soldier, taken as a base, varies between 1·45 m. and 1·8 m. As the mean height generally admitted is 1·665 m., we should, upon taking this as a basis and operating upon extreme heights, commit an error of about one-thirteenth, more or less, of the distance sought. But if, besides the height, we consider (and it is the case here) the breadth of several men, we see that this dimension has less variation, and that we could not assign to the error a value of more than one-fourteenth. This might, moreover, be sensibly reduced by means of operations repeated upon different subjects.

Another cause of error is due to the manner of doing the pacing, which may vary from 0·7 m. to 0·8 m. at the most when some little attention is paid to it, or 0·05 m., more or less, than the normal pace. But the error committed in this case will represent only one thirty-fifth, more or less, of the distance sought, and this may be thrown entirely out of consideration where regulating firing is concerned. The two errors, upon being added, will, at the worst, never give a deviation of more than one-tenth in the real distance, and we shall admit that such an approximation is sufficiently exact if we reflect upon the gross errors that we should commit in estimating by eye, and upon the great variations in range that occur in the best regulated firing.

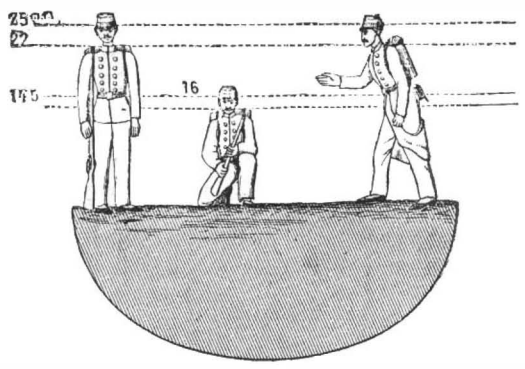

Fig. 2.—APPARATUS FOR ESTIMATING DISTANCES.
(Actual Size.)

Let us add, that with this instrument it is not necessary to see the entire object; if the upper part of a man's body can be seen, it will be sufficient.

In clear weather this process can be applied to distances of 1,000 meters and beyond; but if there is a field glass at one's disposal, it will be preferable to use it for very long distances. In all cases it is well to light the image as much as possible in the same manner as the men observed. If, for example, these latter were in shadow and the instrument were too brightly lighted, it would be necessary to cut off with the hand or cap the solar rays that were falling thereupon.

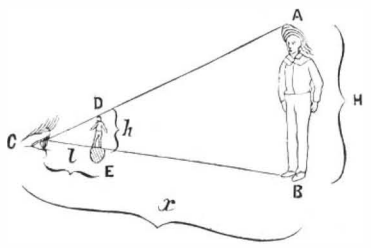

Fig. 3.—APPARATUS FOR ESTIMATING DISTANCES.

It resulted from experiments made at Fort Cagnelot, on the Langre plateau, that, out of thirty measurements, one only could be considered as insufficient, this having given an error of at least one-eighth of the distance. All the rest showed a deviation much less than that which had been fixed on as a limit; and, if a mean of such deviations be sought, it will be found that it was only one twenty-second. The little instrument that we have just described has in nowise the pretension to replace those excellent telemeters that all infantry corps are provided with; but it offers a sure and convenient means of estimating distances, and we believe that a frequent use of it will quickly familiarize the observer with making such estimates by the unaided eye, and this, it should not be forgotten, will always be the most really practical method on the field of battle.—*La Nature.*

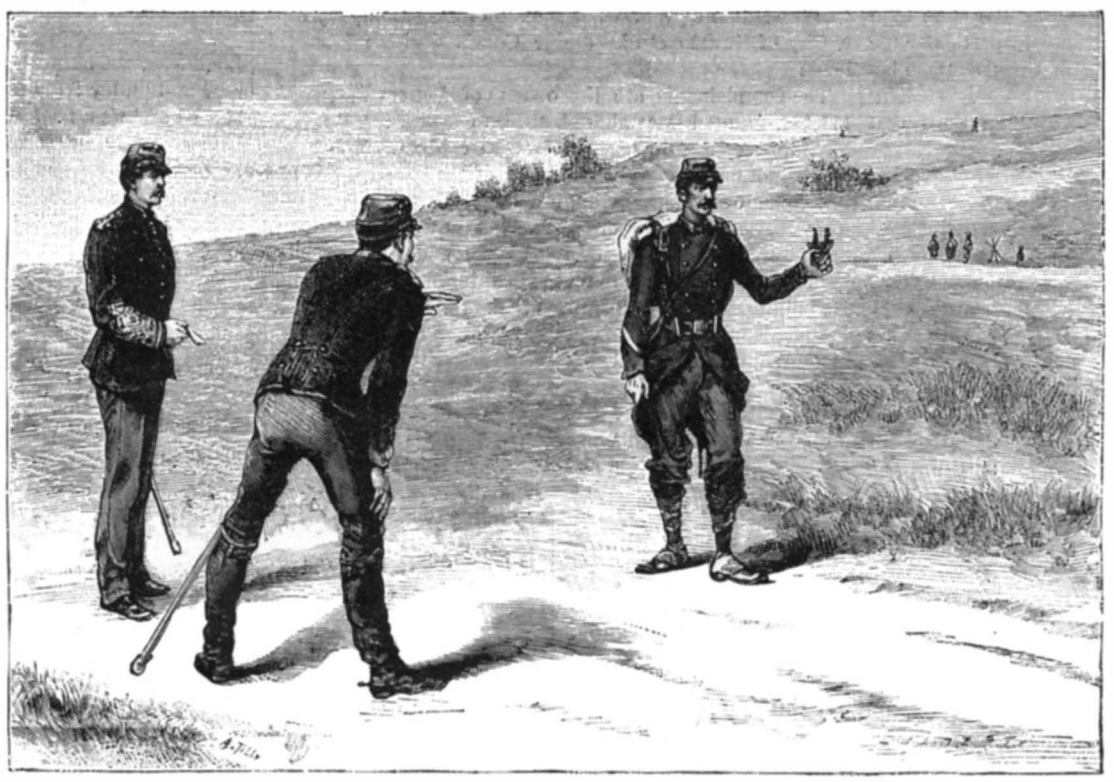

Fig. 1.—METHOD OF ESTIMATING DISTANCES.

The Movements of a Giant Sun.

BY RICHARD A. PROCTOR.

It may be remembered perhaps that when as yet (in the northern hemisphere at least) the great comet of 1882 had only been seen in the full glory of sunlight, and nothing of its real course was known, M. Thollon at Nice from a single spectroscopic observation was able to announce that the comet was receding from us. Nothing more promising perhaps was ever done by the spectroscopic method of determining movements of recession and approach. It had but recently been discovered that some comets show the lines of sodium as well as the broad carbon bands (useless for the method in question), and these lines in the spectrum of the great comet of 1882 had been visible but a short time, and were studied by Thollon but a few minutes. Yet in those few minutes he had been able to detect what seems at the first view hopelessly out of the range of spectroscopic work—the fact that the comet's distance was increasing.

It seems likely that the scientific world will soon hear a good deal of this promising but most difficult line of research. The great star which was the first to respond to the spectroscopic method of measuring motion is beginning to give information of a new and most unexpected character, associated with other strange information which it had given in response to inquiries of another sort.

The giant star Sirius belongs to a class of suns differing in a very marked manner from our own. He is so much larger, judged by the quantity of light which he emits, that for that reason alone we should place him in another class, just as we separate the giant planets from the earth and Mars, Venus and Mercury on the one hand, and from orbs like our sun on the other. Although the average of the best measurements (or rather attempts to measure) of his distance sets him at least fifteen years' light journey from us, he shines much more brightly than any star in the heavens, and, according to the photometric observations of Zollner, about 2 0 times as brightly as our sun would shine if set beside him.

This, assuming the surfaces to be of equal intrinsic luster, would imply a surface 200 times as great, a diameter about 14 times as great, and a volume nearly 3,000 times as great as our sun's. But the spectrum of Sirius gives reason for believing that his intrinsic luster is considerably greater than the sun's, so that we may largely diminish this estimate of his volume. Still we cannot assign to Sirius much less than 1,000 times the volume of the sun; and probably his mass exceeds the sun's in not much less degree. I have just mentioned the spectroscopic evidence as to the quality of his light. Along with about 300 stars out of 600 observed by Secchi he shows a spectrum remarkable for the great strength of the hydrogen lines; and the assumptions seem permissible that all the stars showing this spectrum belong to a higher class (in regard to size and mass) than our sun, that they are younger suns, and glowing with more intense luster.

When the spectroscopic method of measuring movements of approach and recession was first suggested, it naturally occurred to spectroscopists to apply it to this most splendid star. The method itself may be readily indicated, though not quite so readily explained. It is particularly interesting to myself, because it was reading an early adumbration (so to speak) of the actual method, by M. Doppler, which first moved me to commit my thoughts on any scientific subject to paper—as the printed pages of the *Cornhill* (for December, 1863) are "alive this day to testify." I may also mention, with perhaps pardonable pleasure, that I chanced to be the first who publicly enunciated the actual method by which alone successful results can be obtained; albeit this was so clear and obvious a deduction from Doppler's imperfect but pregnant reasoning that it must have occurred to several even earlier, and when I wrote was actually being tested by Huggins and Secchi.

The principle may be thus presented:

Light travels at the rate of some 186,000 miles a second, being propagated (we know not how) in a series of undulations, the broadest waves giving red light, the narrowest giving violet light, the breadths ranging from these extremes through those belonging to the colors red, orange, yellow, green, blue, indigo, and violet. White light is produced by the combination of all these waves, just as noise is produced by the combination of multitudinous sound tones. Now when we cross a series of undulations in water, meeting them as they travel onward, more pass us in any given time than when we are at rest, while if we move the same way so that they overtake us, fewer pass us in a given time. Judging by the number so passing and their known rate of motion, the inference would be (were we uncon-

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scious of our own movement) that they were narrower in the former case and broader in the latter than they really are. Apply this reasoning to sound waves, and it will be seen that if we are approaching a source of sound the sound waves should seem narrower, that is, the tone higher, while if we are receding from the source of sound the sound waves should seem broader or the tone deeper.

Experiment has shown this to be so, the change of tone being found to correspond precisely with that shown by calculation to be due to the measured rate of motion toward or from the source of sound. A rough observation of the change of tone can often be made during railway traveling, especially in America, where, besides steam whistles, bells are used. For it will be found that the tone of the whistle or bell of a passing engine lowers markedly at the moment when in passing the whistle or bell ceases to approach and begins to recede.

Now as light travels in a series of waves, it is manifest that the same law must apply to light as to sound. If we are approaching a source of light of one definite tint, the light waves will be shortened and therefore the tint changed in the direction from red toward violet in the spectrum. If we are receding from such a source of light, there would be a similar change, but in the opposite direction, that is, from whatever the tint might be to a tint somewhat nearer the red end of the spectrum. All that would be necessary in such a case would be that the velocity of approach or recession should be comparable with the velocity of light, or 186,000 miles per second.

Doppler's idea was that movements of recession or approach among the stars might be indicated in this way, the stars of ruddier tints being those which were receding from us, and those of bluer tints being those which were approaching. He overlooked the circumstance that the stars do not shine with definite tints, but with white light, that is, with all the colors of the rainbow combined. It would be impossible to judge by the sound wave test of the approach or recession of something moving with noisy clatter, as to determine by the color test whether a star is approaching or receding. But if among the sounds producing a noisy clatter were only one whose tone was distinct and known we might, despite the noise, determine the question of approach or recession. So if we can select even among the multitudinous tints forming the light of a star a single tint which we know, that tint will tell us of the star's approach or recession, if only the rate of such motion is great enough to cause measurable displacement of the known tint toward either the red or the violet end of the spectrum.

Now in the spectrum of Sirius, as already mentioned, the lines of hydrogen are very strong; they are quite unmistakable also *as* the lines of hydrogen, so that the astronomer can compare any given line of hydrogen—say the one in the red part of the spectrum—with the corresponding line of hydrogen as given by the glowing gas in one of his tubes.

The comparison so made by Dr. W. Huggins, the most skillful of our English spectroscopists, showed that Sirius was receding from the earth at the rate of more than twenty miles an hour. Later observations at our chief national observatory confirmed his results.

So far only what was originally likely enough had been recognized. The observation, like others applied to the stars, showed a more rapid rate of motion among the stars than many astronomers had supposed to exist. In particular the theory of M. Otto Struve that stellar motions average between three and four miles per second was roughly shaken. But I had already shown from other considerations that Otto Struve was probably mistaken.

But of late years the evidence obtained at Greenwich has tended to show that the motion of Sirius is diminishing. And now it is found that the motion of recession has become so slow that we may expect it presently to change into a motion of approach—which may probably increase, reach its maximum, then diminish, change into a motion of recession, and so forth, as though Sirius were traveling in a mighty orbit with movements alternately carrying him toward and from our sun.

Now Peters and Auwers long since showed that the thwart motion of Sirius (that is, the star's apparent motion on the vault of heaven) is affected by a peculiarity indicating orbital motion. Mr. Alvan Clark, the celebrated optician of Cambridge, Mass., discovered a companion of Sirius which has been regarded as probably the cause of the motion of Sirius—*not* the center round which Sirius is traveling, but the cause of the motion of Sirius around the point which is their common center of gravity. The orbit estimated from either star as a center has a diameter not less than 100 times greater than the orbit of the earth round the sun, yet (so great is the combined mass of the two stars) the period of circuit is less than half a century.

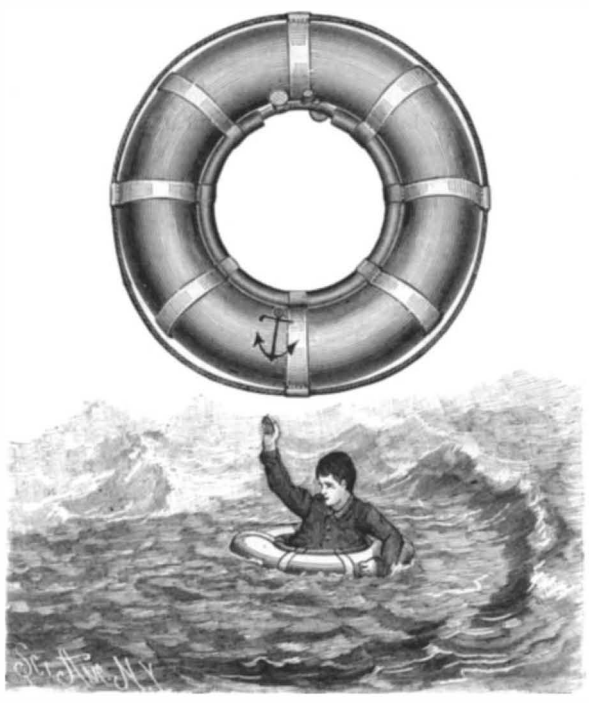
Supposing the mass of Sirius to be ten times greater than the mass of the faint companion, the orbit of Sirius around the common center of gravity would have a diameter certainly not less than nine times that of the earth's orbit, and the average velocity of Sirius in that orbit would be not less than a fifth of the earth's velocity in her orbit, while when nearing perihelion a much greater velocity than this might be attained. Supposing that a portion of the velocity which is in the direction toward and from us to be about ten miles per second, and the system to be traveling at about the same rate from the sun, the apparent velocities in the direction of the line of sight would range from rest to a rate of recession of about twenty miles per second.

Whatever be the actual movements of Sirius, orbital or otherwise, it is clear that the new method of measuring motion is capable of giving us such information about these movements as cannot but help us notably in the determination of their true character. The same method applied to Procyon and other leading stars will probably do more to enable science to interpret the constitution of the stellar heavens than any method devised since astronomy became a science.—*Knowledge.*

AUTOMATIC WAVE LUBRICATING LIFE BUOY.

The life buoy herewith illustrated consists of a seamless brass reservoir running entirely around the inside. The oil is filled in through a hole in the top, which is then covered by a cap which screws on. On each side of the upper part of the oil tube is placed a rose—similar to those placed upon sprinkling cans—so that when the life buoy is hung upon the vessel's stern no oil can escape; but the moment it is placed horizontally the liquid begins to escape and covers the sea with a thin film of oil, spreading out rapidly on every side until a large circle is formed, within which the person who has fallen overboard may rest until rescued by the boats.

This buoy is the invention of Mr. G. Foster Howell, and



HOWELL'S AUTOMATIC WAVE LUBRICATING LIFE BUOY.

is manufactured by Mr. D. Kahnweiler, of 146 Worth Street, New York city, of whom further particulars may be obtained.

Harnesses for Fire Engine Horses.

A trial lately took place in the U. S. Circuit Court, Northern District of New York, in which the presiding judge gives in his decision several very interesting particulars. It was the action of Worswick Manufacturing Company *et al. v.* City of Buffalo *et al.* Judge Coxe's decision is as follows:

The complainants are the owners of Letters Patent No. 171,190, granted December 14, 1875, to Edward O. Sullivan, for improvements in harness for fire engines. The patent relates not only to the construction of the harness, but also to the manner of suspending it above the horse. The object of the invention is to enable the horses to be kept unharnessed until the moment of the alarm, and then to attach them to the engine with great expedition. One man is thus enabled to do the work of three under the old system. The harness is made in sections, is permanently fastened to the neap or thills, and suspended from the ceiling by means of straps and spring catches, so that it may be dropped upon the horses and quickly secured.

Before the use of this apparatus, horses were kept continually in harness night and day. The result was that they were irritated and galled, and the harness was injured and soon destroyed by the constant rubbing which this irritation occasioned.

There can be no doubt regarding the utility of the invention. Its advantages may be summarized as follows: relief to the horses, expedition in reaching the fire, durability and reliability of the harness, economy in the employment of firemen and harness makers. And when it is remembered that promptness in arriving at a fire has often prevented a great conflagration, the indirect benefits can hardly be estimated.

The claim in controversy is the third. It is in these words:

3. The combination, with a harness for a fire engine or like apparatus, of a device for suspending said harness above the place occupied by the horse when attached to the apparatus, substantially as and for the purpose set forth.

The defenses interposed are, first, the claim is void for the reason that there is an attempt to patent a mere abstraction—the idea of suspending a harness from the ceiling in a particular place; second, the defendants do not infringe if the claim is confined to the particular mechanism described in the specification; third, the patentee was not the original inventor.

So far as the records of the Patent Office show, Sullivan was the first to enter this field of invention. No other patent, American or foreign, is introduced to anticipate or limit the claim referred to. It should, therefore, be construed, broadly, to cover any similar apparatus which suspends a harness in substantially the same manner. The details of construction both in the harness and the suspending apparatus are non-essentials, inferior, and subordinate to the principle embodied in the patent, which is the paramount and superior consideration. The man who first conceived the idea of suspending the harness above the horse and put it into successful and practical operation is the one who conferred the benefit, and is entitled to the reward. It would be an exceedingly illiberal and narrow construction to hold that he should be deprived of the fruits of his ingenuity by one who simply changed the form of the harness or of the device by which it is suspended. No principle is better settled than that a mere abstract idea is not the subject of a patent, but that principle has little application here for the reason that the inventor has put his idea into tangible shape and given it form and substance. For years the problem was how to get the engine to the scene of the fire in the shortest possible time. By a combination of old devices Sullivan has reduced time to the minimum, and accomplished a confessedly beneficial result. It is not an abstraction he seeks to secure, but the apparatus by which the idea is carried out. With the claim thus construed, and in view of the state of the art, very little need be said upon the question of infringement.

The defendants have adopted an analogous combination. The harness and hoisting apparatus used by them are substantially the same as those described in the patent. They have quite likely introduced some improvements; they have employed the well known mechanical equivalent of a pulley and weight for a coiled spring; they suspend the whole harness and attach no part of it to the pole, and there are minor points of difference between the two mechanisms; but in all essential particulars they are alike.

The main effort on the part of the defendants has been to show that Sullivan was not the original inventor. Here the burden is upon them to satisfy the court beyond a reasonable doubt. A mere preponderance of evidence is not enough. The proof must be of such a convincing character that the court can say without hesitancy that the allegations of the answer in that behalf are true. Has such proof been offered? It is thought not.

A fair conclusion to draw from the evidence is that the defendants have succeeded only in casting doubt upon the title of the patentee. Instead of capturing the citadel, they have simply made a breach. True it is that before the patent vague conceptions of the invention had entered other minds; true it is that others had approximated more or less closely to the successful realization. No one had quite reached the goal. The evidence shows that in one instance, while the horse was standing harnessed in the stall, the collar was, by means of a cord, pulley, and weight, raised on his neck to prevent chafing, heat, and irritation. In another case a single harness, without collar and hames, was attached to the thills of a light fire wagon. The harness and thills were elevated to the ceiling by a rope, pulley, and weight. A similar method was at another time applied to the harness of hose carts, excepting that the collar and hames were left on the horse.

There was also evidence tending to show that in 1872, at Louisville, the harness of a hose cart was suspended by a rope and pulley from the ceiling, and that the collar was hinged and was fastened by a snap or spring lock at the bottom. No witness was called who recollected seeing a harness for fire engines suspended prior to the date of the patent. But, if not discredited, the evidence relating to the Louisville apparatus would certainly have the effect of restricting the claim within exceedingly narrow limits. The complainants have, however, succeeded in showing that there may well be a mistake both as to the time when and the manner in which the harness was suspended at Louisville. The chief and assistant chief of the fire department of that city during the year 1872 never saw or heard of the apparatus described by the defendant's witnesses. The chief next in succession, who previous to his elevation to that office had been in and about the engine houses for twenty years, gave like evidence. A member of the Cleveland fire department, who came to Louisville in 1879 for the purpose of explaining and introducing the Sullivan apparatus, testified that he visited the different engine houses, but saw nothing at all resembling a swinging harness. The Louisville firemen were surprised and pleased with the invention, and it was immediately adopted by them. It must, therefore, be said within the rule heretofore adverted to that the defendants have not succeeded in establishing their defense.

Decree given for an injunction and an account, with costs.

Protecting Steel and Iron from Rust.

Professor Calvert has recently made the interesting discovery by practical tests, that the carbonates of potash and soda possess the same property of protecting iron and steel from rust as do those alkalies in a caustic state. Thus it is found that, if an iron blade be immersed in a solution of either of the above carbonates, it exercises so protective an action that that portion of the iron which is exposed to the influence of the damp atmospheric air does not oxidize, even after so extended a period as two years. Similar results, it appears, have also been obtained with sea water, on adding to the same the carbonates of potash and soda in suitable proportion.

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ENGINEERING INVENTIONS.

A steam boiler has been patented by Mr. Samuel P. Hedges, of Greenport, N. Y. It has vertical and horizontal cylinders with inlet and blow-off pipes, and with projecting pipes having interior circulation pipes, whereby steam will be generated quickly, and all the parts are easily accessible.

An axle box lid has been patented by Mr. John C. Albrecht, of Columbus, Ga. The axle box has beveled end and vertical side grooves, and the inclined lid has side flanges, the object being to provide a lid which will always be oil tight when closed, and which can be easily opened and locked in the open position.

A hoisting machine has been patented by Mr. Cornele G. Ross, of Rutland, Vt. This invention covers contrivances for unwinding or overhauling the rope of the drum more rapidly than it can ordinarily be done, to economize time when working in deep mines, quarries, etc., where considerable length of rope is required.

A clamp plate for railroad rails has been patented by Mr. Thomas J. Bush, of Lexington, Ky. This invention covers improvements on former patented inventions of the same inventor, and covers a plate adapted to be placed upon the cross tie and flange of a railroad rail, combined with interlocking bolts inserted in the plate and cross tie parallel with the rail.

A dredger has been patented by Mr. Geo. A. Callanan, of New Comerstown, Ohio. The invention covers improved contrivances for working a scoop for dredging out canals and rivers by a derrick and boom erected on the bank, and floats from which to guide and control the scoop, with improvements in its construction for regulating its dip.

A car wheel has been patented by Mr. William H. Herbertson, of Brownsville, Pa. The invention covers more especially an improved device for oiling axles of coal cars, there being a central oil cavity in the wheel, and inclined bars adapted to rest against the surface of the axle, the contrivance saving time and labor, and all waste of lubricating material being obviated.

A base burning steam boiler has been patented by Mr. Micheal E. Herbert, of St. Joseph, Mo. It is an upright boiler, with a downwardly projecting annular chamber at its outer periphery, and a similar chamber at the point where it encompasses the fuel magazine, with other novel features, giving a great extent of heating surface without the complication of a great number of flues.

An automatic hydraulic signaling apparatus for railways has been patented by Mr. Frederick W. Malcolm, of Cincinnati, O. The apparatus is constructed with a hinged bar, a signaling post, and a slotted semaphore arm, the bar being connected to the arm by a piston and piston chamber, an air chamber with a perforated valve, pipes connecting the air chamber with a piston chamber, etc., so the semaphore arm will be displayed by the expansion of air compressed by the weight of the advancing train.

MECHANICAL INVENTIONS.

A lathe dog has been patented by Mr. Samuel N. Silver, of Auburn, Me. Combined with the face plate of a lathe is a casting or plate with jaws and receiving a set screw from the face plate, an apertured plate being held between the jaws, while the set screw serves as a pivot for the apertured plate, with various other novel features.

Watchmakers' pliers are the subject of a patent issued to Mr. Calvin W. Little, of Denver, Col. The invention covers a novel construction, one of the jaws being flattened to a chisel edge and slotted, and the other made longer and having beyond the end of the lower jaw a bearing for the watch face, the whole being designed to facilitate the removal of the hands from a watch without straining or twisting the hands or the shaft to which they are applied.

AGRICULTURAL INVENTIONS.

A peanut planter has been patented by Mr. Christopher C. Boykin, of Ivor, Va. The invention covers a combination with slides having cups, of adjustable plates adapted to be set nearer to or farther from the same, to regulate the capacity of the cups, with various other novel features to improve wheeled planters for planting peanuts, peas, or other seeds.

A cultivating harrow has been patented by Mr. Joyeux Collins, of Tyro, Ark. This invention covers a novel construction, so the harrow can be drawn along a row of plants to cultivate both sides at the same time, or the space between two rows, so as to cultivate their adjacent sides at the same time, the side parts of the harrow, in either case, adjusting themselves to the inclination of the sides of the ridges.

MISCELLANEOUS INVENTIONS.

A fire kindler has been patented by Mr. George C. Kiesewetter, of Hoboken, N. J. The invention covers a composition of matter in specified proportions, made into cakes, consisting of resin, benzine, water, caustic soda, raw oil, nitrate of lead, sulphate of magnesia, etc.

A wire fence has been patented by Mr. Richard B. Combs, of Cincinnati, Ohio. The invention covers a combination of improved wire straining and fastening devices, improved post brace for wire fences, with novel support for the wires, and other special features in design and consfruction.

A cabbage slicer has been patented by Mr. Theodore A. Cook, of Brooklyn, N. Y. The knives have a double action, making the device do its work very rapidly, and an eccentric lever is so arranged that it is very easy to operate, making a machine that is cheap, durable, and practical for its purpose.

A hand loop for driving reins has been patented by Messrs. Charles E. Rand and Francis H. Audley, of New York city. The invention covers a series of hand loops, with an end loop, slides, and keepers for securing the hand loops to a driving rein, and readily adjusting them upon the rein.

Scenery for theatrical plays is the subject of a patent issued to Mr. Frank L. Rees, of Bridgeport, Conn. This invention covers such an arrangement of partitions as to enable the actors to appear in five different apartments, each of which is exposed to the view of the audience at the same time.

A hay elevator and carrier has been patented by Mr. Abner J. Burbank, of Harvard, Ill. The invention combines with a weighted lever and stop a curved arm and catch, and various other novel features to enable the carrier to be run in either direction, the locking and tripping gear being simple and efficient.

An oil cup faucet has been patented by Mr. John S. McGuire, of Centerville, N. J. In combination with a screw neck is a spout, an apertured plate with a washer, and a screw cap with a valve plate, thus providing a cap for closing the spouts of oil cans, and one which also serves as a faucet.

A vehicle spring has been patented by Mr. George B. Malette, of Watkins, N. Y. It is a device of corrugated or serpentine anti-friction spring, with novel devices for so connecting with the vehicle that the body of the latter will always be depressed equally without reference to the locality of the load.

A bill or letter file has been patented by Mr. Michael B. Hurly, of Quebec, Canada. This invention relates to bill files formed with a wire stringer having jointed ends, on which bills or letters are strung after being punctured by the wire, for which purpose a device of novel construction is provided.

A method of securing heels to rubber boots has been patented by Mr. Alfred V. B. Carlisle, of New Brunswick, N. J. The method consists in applying the heel to the outsole, inserting screws through the outsole into the heel, and then connecting the outsole and heel to the body of the boot and vulcanizing the same, so that the screws will be wholly embedded in rubber.

A buck for beer coolers has been patented by Mr. Frank T. Cladek, of Rahway, N. J. The invention covers an improved swing beer buck for refrigerators used for holding beer on tap, the buck being adapted to be swung out of the refrigerator for facilitating the labor of placing the keg of beer in and removing the empty keg.

A thill loop for harness has been patented by Mr. Alexander C. Davison, of Jefferson City, Mo. It consists of a metallic core, with an anti-friction supporting roller at its lower end, with various novel devices for greater convenience in attaching and detaching the hold back strap, besides being cheap and durable.

A protector for harness saddle skirts has been patented by Mr. Ephraim K. Dennis, of New Bedford, Mass. The protector is made with a cushion having a nut in its back, and a screw for securing the cushion to the back strap, to keep the latter out of contact with the saddle skirt, and thus prevent the latter from being chafed and marred.

A paper or letter box has been patented by Mr. Harry Stocks, of Lowell, Mass. The invention consists in a box with a side opening and a slot in its bottom, the edges of the slot being turned inward to form flanges, the box being held to the door or casing in such manner that the side opening is closed when the door is closed.

An improved perpetual calendar has been patented by Mr. Thomas A. Bereman, of Mount Pleasant, Iowa. The object of this invention is to show at a glance the different days of the month on which any day of the week occurs, the device to be easily changed to give the same information relative to any month of any past or future year.

An inner sole for boots and shoes has been patented by Mr. Albert G. Gardner, of Portsmouth, O. It is flexible, and has a flexible filling in its center, whereby the "brace" is taken out of the inner sole against the outer sole without damaging the wear, a heavier outer sole may be used, and a more flexible boot or shoe is obtained.

A hot bed sash has been patented by Mr. Charles J. Asimus, of Guttenberg, N. J. The invention covers a novel construction of the mullions or strips dividing the contiguous glasses of the frame, and the means for supporting and holding them, so in case of the rotting or breaking of the mullions or strips they can be readily removed and replaced without disturbing the frame.

A twine holder has been patented by Mr. Reuben Melvin, of Cincinnati, O. In combination with the receptacle for the ball of twine is a band or cord with a weight at one end and a ring or eye at the opposite end, through which the free end of the twine is passed, making a device by which the end of the twine is kept out of the way, but can at all times be reached easily.

A wheel for roller skates has been patented by Mr. Edward F. Johnson, of Jersey City, N. J. The wheel is a combination of saucer-shaped side plates, central block, and leather rim, the latter serving both as felly and tire to the wheel, although instead of leather rubber or other flexible material may be used, making a wheel that is light and cheap, but strong and durable.

A mould and mould hoisting apparatus for building concrete walls has been patented by Mr. Thomas W. Carrico, of San Antonio, Texas. The invention consists in a mould in which a course of the wall can be formed, and in devices for raising the mould for the formation of another course, the construction being novel, and such as will facilitate building operations.

A tobacco mould has been patented by Mr. James M. Gaston, of Louisville, Ky. The invention covers improvements in the construction of moulds, for more readily adjusting them to plugs of different sizes, and also a contrivance for arranging several series of moulds and followers in frames, the series being readily lifted apart after pressing, to facilitate removing the plugs and refilling.

A draught equalizer has been patented by Mr. Benjamin W. Sutherlen, of Fillmore, Minn. The invention covers a novel construction and combination of parts, whereby the draught upon a three horse team is perfectly equalized, the horses are allowed to travel close up to both sides of the pole, side draught is prevented, and the evener is supported from the ground, with other advantages.

A fire escape has been patented by Mr. Don Juan Arnold, of Brownville, Neb. There is a special combination of cord, drum, high speed brake wheel, brake, and governor, with any approved form of sling, and other devices and attachments, whereby either goods or persons may be lowered from a burning building, the machine being attached near a window, and made ready for use by simply throwing out a rope.

A fire kindler has been patented by Mr. Eugene J. Dunbar, of Romulus, Mich. The invention consists of a coal or carbon kindling made with an exterior film of hard, smooth, resinous matter that incloses the coal or carbon and prevents soiling, but is readily inflammable; this improved kindling has been used for the firing of locomotives, and is obtaining much favor for domestic use.

A device for truing grindstones has been patented by Mr. Chester A. Weller, of New York city. A rigid bed carries a nut plate and screw, a frame sliding in ways and carrying housings, a shaft journaled in the housings having cutter disks with intermediate elastic spaces, with other devices of novel design and combination, for dressing stones by traversing rotary cutters across their faces.

A trunk lock has been patented by Mr. Mortimer C. Ogden, of Brooklyn, N. Y. The lock casing has a raised part with a rim, the mechanism being entirely within the raised part, and not projecting beyond the inner surface of the rim or flanges, the object being to provide a lock which can be secured on the outer surface of the trunk, without the necessity of mortising or cutting the surface of the trunk.

A steam generator has been patented by Mr. James W. Bailey, of Monmouth, Ill. This invention is designed more particularly for steam heating purposes, and covers a novel sectional arrangement whereby the circulation of the water diminishes at a distance from the fire when the fire is low, while steam is still generated near the fire more effectively than it would otherwise be.

A fishing machine has been patented by Mr. Thornton F. Williams, of Cascade Locks, Ore. A wheel with revolving dip nets is mounted on a scow, the supports being arranged on an extension at the stern, and the nets having double inclined chutes for discharging the fish out of each end of the wheel and conveying them into the hold of the scow, the wheel arms having buckets for rotating the nets.

A coffee roaster has been patented by Mr. Napoleon B. Powell, of Versailles, Ill. This invention covers improvements on a former patent issued to the same inventor, the feet that support the shaft and cylinder being so connected by an extensible bar and clamping screw that the roaster will be held from longitudinal movement in the stove oven, and the cylinder can be readily detached from its supports.

A combined fifteen ball pool rack and spotter has been patented by Mr. William A. Tea, of Clyde, Ohio. This invention relates to improvements on a former patented invention of the same inventor, and consists in the construction and arrangement of the parts of the rack, and of the trough or conduit attached to it, and in the attachment of the triangle for spotting, whereby the balls may be accurately and automatically spotted.

A paddle wheel has been patented by Mr. Andrew S. Morrison, of Portland, Ore. This invention provides a wheel which automatically adjusts itself according to the current, the paddles being on two circular frames, of which the inner one is rigidly mounted on the shaft and the outer one is mounted loosely, so that when the pressure is greater on the outer ends of the paddles they will be inclined accordingly.

A heel for rubber boots or shoes has been patented by Mr. Walter Southwick, of New York city. The invention relates to that class of heels where an outer plate of rubber, leather, wood, or roughened metal is used to protect the heel, and prevent the wearer from slipping on ice; the heel is made very firm and strong, is of novel construction, and cannot by any common usage be detached from the bottom or sole of the boot or shoe.

A curve for portable railroads has been patented by Mr. George W. Thomas, of Fuselier Home Place, La. This invention is an improvement on a former patented invention of the same inventor, and consists of two curved rails united by ties, on each end of which curved rail a tongue is hinged; the curve thus formed being placed on a crossing, the tongues are inclined from the ends of the curved rails to the surface of the regular track.

Common Sense Chairs.

Several years ago, about the time Mr. F. A. Sinclair commenced the manufacture of his now world wide known chairs, at Mottville, N. Y., he sent to the office of this paper specimens of his several styles of manufacture. Those first sent have passed away, but others have been ordered from time to time from Mr. Sinclair's manufactory, and the result is that we have had the Common Sense chairs in constant use for many years, and for the piazza, hall, sitting room, or parlor of a country house we know of no kind of seat so comfortable and satisfactory to the user as the Sinclair chair. From a small beginning Mr. Sinclair has built up a very large business, and has added to the production of chairs the manufacture of settees and other seats of double cane or ash splints all mounted in hard wood frames. For hotels and country boarding houses, the Common Sense chairs and settees of Mr. Sinclair are not surpassed by any other class of goods, and parties furnishing country houses and desiring inexpensive, comfortable, and durable furniture will do well to write to Mr. F. A. Sinclair, at Mottville, N. Y., for a copy of his handbook, which contains illustrations of the various articles he manufactures, with a schedule of prices.

Rendering Paper Uninflammable.

Gaspard Meyer, of Paris, France, obtained a U. S. patent July 3, 1883, for rendering paper incombustible, by the adding to the pulp while in process of manufacture into paper, asbestos fiber, mica, flint silicum pulverized, or any other silicate. Mr. Lara, who represents the patentee, has recently arrived in New York for the purpose of introducing the invention in this country, and a few days ago he made some experiments at Staten Island before representatives of the fire department and a number of gentlemen, who had been invited to witness his exhibition. A small, dry, pine wood building was constructed, the walls and rafters of which were covered with the incombustible paper. After the fire had been kindled the heat was intensified by frequent injection of petroleum and incandescent masses of tar, all of which the building withstood, much to the gratification of those who witnessed the experiment.

Business and Personal.

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John Stuart Mill had a pipe sticking around in nearly every tree and nook of his spacious lawn. In his walks he regaled himself frequently with a smoke. He changed his pipe often, but when he struck a superior tobacco like Blackwell's Durham Long Cut, he stuck to it like a philosopher, evolving political economy from the smoke thereof.

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Stephen's Vises. Special size for amateurs. See p. 13.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressors, address Geo. F. Blake Mfg. Co., 44 Washington St., Boston; 97 Liberty St., N Y. Send for Catalogue.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent agency, 361 Broadway, New York.

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Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Curtis Pressure Regulator and Steam Trap. See p. 12.

Munson's Improved Portable Mills, Utica, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 14.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 13.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 286.

Drop Forgings. Billings & Spencer Co., Hartford, Conn.

Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 46.

Gear Cutting. Grant, 66 Beverly St., Boston.

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Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

NEW BOOKS AND PUBLICATIONS.

MODERN HIGH EXPLOSIVES. By Manuel Eissler, Mining Engineer. John Wiley & Sons, New York.

This book is one for the engineer, the contractor, and the manufacturer of explosives—full details of the methods of production being given as a part of the explanation of the nature and power of the various explosives. The production of glycerine is followed, from its first manufacture in a commercial way in 1850 down to the most recent and greatly improved processes; the dangers, and the best protection against them, in making nitroglycerine are pointed out, and the various kinds of dynamite—from those made with infusorial earth and a large percentage of nitroglycerine down through those with lower explosives and chemically combining with the nitroglycerine—are described as to their manufacture, storage and transportation, and effectiveness for various uses. Gun cotton and the fulminating compounds are likewise fully treated, also electricity as applied to blasting operations, many examples being given from well known engineering works and the author's practical experience in mining. The applications of these explosives for military purposes are only mentioned briefly, the design of the work being principally to promote industrial ends, and, by disseminating more correct ideas, render the handling and use of these powerful destructive agents more safe.

THE MATERIALS OF ENGINEERING. By R. H. Thurston. John Wiley & Sons, New York.

This is the third volume of Professor Thurston on this general subject, the present book being devoted to the non-ferrous metals and their alloys—copper, tin, zinc, brass, bronze, etc. It treats generally of the properties of the metals and their alloys, and their manufacture and working, but will be more especially useful for what it says relative to their strength—elastic limits, resistance to compression and transverse stress, etc.—under varying conditions. The volume tabulates and analyzes a great number of tests of brasses, bronzes, and like alloys, made by the United States Government, and by the author personally at the Mechanical Laboratory of the Stevens Institute of Technology.

MODERN FOREST ECONOMY. By J. Croumbie Brown, LL.D. Oliver & Dowd, Edinburgh.

This is the eleventh volume of the author on subjects directly connected with that indicated in the title of the present book. He believes in forest culture and preservation, and has especially studied the subject as it is brought to mind by the present and past conditions in England and Scotland, and in the various countries of Europe, as also in South Africa, where he was for some time Professor of Botany at the Cape of Good Hope. The present volume treats of the true elements of forest economy and forest administration, classing the latter as a science of no mean order, and advocating the organization of schools of forestry. It is well worth the reading of those who are now so earnestly urging that something be done to prevent the total destruction of our own forests which is so rapidly going on.

WROUGHT IRON AND STEEL IN CONSTRUCTION. John Wiley & Sons, New York.

A hand book of rules and tables for the strength of wrought iron shapes used as beams, struts, shafts, etc., manufactured by the Pencoyd Iron Works.

METROLOGICAL SYSTEM OF THE GREAT PYRAMID. By F. A. P. Barnard, LL.D. John Wiley & Sons, New York.

This is a reprint of a paper read before the American Metrological Society, in which President Barnard summarizes the tenets of the pyramid faith, and investigates the deductions made by those who thus believe, besides advancing a new theory of his own.

THE METHOD OF LEAST SQUARES. By Mansfield Merriman. John Wiley & Sons, New York.

The elimination of error in numerical observations, and the best method of reaching as nearly as possible absolute accuracy in measurements and computations more or less indirect, is here made the subject of a carefully prepared text book by the Professor of Civil Engineering at the Lehigh University. It has been the endeavor of the author to present this by no means simple subject in a manner so plain and direct, that civil engineers who have not had extended mathematical training may be assisted thereby, and the numerous practical examples given afford a comparatively easy road to the acquirement of such knowledge of the higher mathematics as is essential to the engineer, while the book is one in which the industrious student will make rapid progress.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) O. K. L. asks: Can water 80–90° Fah. be forced by means of a hydraulic force pump under pressure 70-80 pounds into the pores of wood which has been cut across the grain in blocks a quarter of an inch thickness and put in an air tight copper or iron vessel? If so, how long a time would it take for the water to reach the center of the blocks of wood a quarter of an inch thick? Would exhausting the air from the vessel (and so in part from the wood blocks) before permitting the water to come in, facilitate the penetration of water subsequently forced under hydraulic pressure, as before described? A. Water should penetrate the blocks of wood, under the circumstances mentioned, in a few minutes. The air in the wood would be compressed to about one-fifth its volume, and would be absorbed by the water, which might take several hours. If the compression is only for a few minutes, it is possible that the air, not being absorbed, would drive out part of the water by its expansion. Exhausting the air at first would insure the immediate penetration of the water under pressure. Fill the vessel with steam, and allow it to condense; this will probably produce sufficient vacuum.

(2) T. P. Y. asks: What kind and size of pipe is best to lay from a spring of ordinary soft water, 80 rods distance and 25 feet fall, for family and barn use? Will it be best to take a slight curve from a straight line to save a sag, or not? A. The size of pipe depends upon the quantity of water you may require and the capacity of the spring; 1 inch pipe will give a constant flow of 5 gallons per minute, 1¼ inch pipe 9 gallons per minute, 1½ inch pipe 15 gallons. A galvanized iron pipe is best. It will make no difference about the sag, except as every bend from the straight line increases the friction, and this would not be saved by laying the pipe in a circuitous line.

(3) F. W. F. says: I have a flat iron casting about three feet long and two wide, which represents in relief the siege of Troy. Can I cover this with a film of metallic copper or treat it with any solution to make it resemble the bronze so much admired? A. You will find a description of Process for Bronzing Iron in No. 235, SCIENTIFIC AMERICAN SUPPLEMENT. Also Imitation Bronzing in SCIENTIFIC AMERICAN SUPPLEMENT, No. 28.

(4) A. B. wants to know how best and cheapest to get rid of partially decayed pine and oak stumps, and cheap and simple device or implement for pulling them? Or is blasting cheapest and best, reducing them to fragments so they can be handled and burned? A. A wooden lever with three clevises, chains and hooks makes a simple and easily arranged device for pulling stumps. For blasting them see SCIENTIFIC AMERICAN, December 1, 1883, page 341.

(5) R. M. H. says: 1. Providing the slide valve on a locomotive has a certain lead, can lead be either increased or decreased by any other means than by slipping eccentric? A. We understand that it cannot except by altering the construction of the valve. 2. Has the reversing lever any other control over the valve than its name implies, and to regulate the throw or travel of slide valve, independent of any influence on lead? A. The reversing lever regulates the amount of the throw of the valve or cuts off the steam when on center, having no control over the lead.

(6) P. T. asks the best mode for pumping out a lake containing about 250,000 cubic yards water, the kind of pump to be used, amount of horse power to accomplish certain results, cost of pumps, etc. A. A pump and boiler capable of pumping out your lake in 50 days of 20 hours each will cost about $1,000 in New York. Boiler 12 horse, steam cylinder 8x12, water cylinder 10x12. Much depends upon how high the water has to be pumped and length of pipes required, which for such a pump should be 6 inches suction, 4 inches force.

(7) J. E. T. says: I have been trying to do a little tinning, such as dipping table cutlery in a pot of melted block tin, and have met with rather poor success. My melted tin seems to be too thick, and will not run off smooth, but leaves the knife rough. How shall I make the melted tin thinner or run smooth on article tinned? A. You may have used your tin bath too long. The tin absorbs a little iron, or it may be too cold. A little powdered salammoniac sprinkled on the surface tends to clear it.

(8) J. F. L.—Water meters are read in the same manner as gas meters. The 1st dial is cubic feet up to 100; 2d dial is cubic feet by 100 for each figure; 3d dial 1,000 cubic feet for each figure, and so on to the 6th, each dial indicating 10 times the amount of the whole of the preceding dial. Always read the figure behind the index in the direction that it moves. The index hands alternate to the right and left in their motion to accommodate the plan of gearing.

(9) J. L. asks if water impregnated with sulphur will be injurious to steam boilers, and how to determine whether sulphur is present in the water. A. Yes. The sulphur combines with the iron, making it brittle. If you suspect sulphur in the water, you may detect it by the smell of bad eggs. If there is too little to detect in this way, boil a clean piece of silver (quarter dollar) in some of the water; sulphur turns it black.

(10) M. M. W. asks if there is any preparation of metal in liquid form of unlimited supply that is cheaper than quicksilver? A. There is none.

(11) J. P. says: I want to cast a number of small bells not exactly the usual shape, and cannot use copper because it requires too much heat to melt it. What combination of metals of low fusing point can I use, and is there any process of making the base metals sonorous? A. You cannot make any combination of metals properly sonorous at a low fusing point.

(12) E. C. H. asks about mica and isinglass. Can they be bent or moulded into any shape? Do they stand a high degree of heat when applied in the form of water or steam? Is there any work published which treats of these articles? A. Mica is the proper name for isinglass. It is a silicate of alumina, with a little potassa. It is not plastic or capable of being moulded. It will stand any heat below red. In steam and boiling water it is disposed to become opaque by dissolving of potassa from the surface. See Dana's Mineralogy for a description and analysis of all kinds of mica.

(13) C. F. A. asks: What is nickel, and where does it come from? Please give a short account of it. A. Nickel is a metal first known more than a hundred years ago. Its ores are mined the same as iron, copper, etc. It mostly comes from Germany, France, and England. There are mines in the highland range in the State of New York, and other places. It has also been found in small quantities in the meteorites that fall upon the earth.

(14) C. B. R. asks the name and character of insects sent; they were found attached to a rope swing on a scrub oak tree. A. The specimens are the larvæ and pupæ of the Twice-stabbed Ladybird (*Chilocorus bivulnerus;* family Coccinellidæ), a common and very useful little beetle, preying as larva and imago on plant lice and scale insects. The larva is easily recognizable by its body being covered with very stout, long, black, prickly spines, the perfect beetle being black with a red spot on each wing case. The specimens evidently attached themselves to the rope to undergo their transformation.

(15) I. K. asks: 1. What is the surest way for a family to find out if there is any sewer gas in their house? A. Sewer gas has a peculiar pungent, sickening odor; when once familiar with it a person will readily recognize it in a house. The surest way is to have a reliable plumber examine the premises. If you cannot trust a plumber, obtain the services of some of our sanitary engineers or experts. 2. What is the best way to clean or renovate old steel engravings? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 44,115, 124, for directions for cleaning old steel plate prints.

(16) W. S. asks where one can be educated for civil engineering, and what primary learning is required. A. There are special courses of civil engineering at the School of Mines of Columbia College, and also at the College of the City of New York. The great school of civil engineering in the country is the Rensselaer Polytechnic at Troy, N. Y. The requirements vary with the institution, and can be ascertained by consulting the catalogues. These can readily be procured by application.

(17) S. E. C. asks a recipe for making sulphur soap? A. Take half a pound white curd or castile soap (recent), 1 ounce best flowers of sulphur (levigated), 1 fluid ounce rectified spirit (strongly colored with alkanet), and sufficient attar of roses to strongly scent the mass. Beat the whole together, to a smooth paste, in a marble or Wedgwood mortar. The spirit and coloring matter may be omitted at will, and as a toilet soap one-half the above quantity of sulphur will be found sufficient.

(18) A. B. J. asks for a solution or dip that will give luster to tinned articles. A. Tin may be cleansed by a rapid scouring with potash lye and a rubbing with a hard substance. Sometimes dipping into hydrochloric acid is beneficial, but the first operation is generally necessary. Answer to query 8 in the SCIENTIFIC AMERICAN for May 10, 1884, gives some information on this subject.

(19) D. S. writes: The elm with us is infested by some insect; a majority of the leaves are like the one I inclose herein. What are the cause and remedies for it? A. It is impossible without better specimens to say precisely what the insect is, but we think likely that it is the canker worm, which injures the elm as well as the apple tree. The most approved remedies are as follows: To prevent the pests from going from tree to tree, a band of canvas or paper is wrapped around the trunk and besmeared with tar or a mixture of tar and molasses, which must be frequently applied; or a band of rope or closely twisted hay is put around the trunk and over this a tin band about 4 inches wide, so placed that the rope shall be at the middle of the two, in such a manner that there will be a cavity below and a free edge above it. If these insects are prevented from ascending the tree, they will deposit their eggs below the obstruction and near it, and the eggs can be destroyed by a single application of kerosene oil. This should be done about March in this latitude, and earlier further south. If the worms have been permitted to hatch, as soon as they are large enough to be seen jar them from the trees and sweep away with a pole, as they hang by their threads, and burn or otherwise destroy them. If the worms have matured and gone into the ground for winter quarters, plow the ground late in the fall so as to expose the pupæ to frost and to their natural enemies. See also Professor A. S. Packard's article on the canker worm, page 304 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 19.

(20) U. M. F. Co. ask for a cement that will set almost instantly for uniting leather together. A. Gutta percha dissolved in carbon disulphide to form a mass of ropy consistence forms a very good cement for splicing leather. The parts to be joined must be thinned down, a small quantity of the cement is then poured on each end, spread so as to thoroughly fill all the pores of the leather; the parts are warmed over a fire for a few minutes, applied quickly, and hammered well together.

(21) J. E. N. writes: I make a "burnish ink" for shoes of extract logwood, potassa bichromate, and copperas which does not strike in deep enough. Can you suggest the addition of anything, that is cheap, that will make it bite well, or can you furnish a good formula? A. The following are the proportions of an ink similar to your own, but perhaps it may give better results: Make a strong decoction of logwood, preferably in soft water, by boiling; then add iron sulphate, at the rate of 2 ounces to the gallon, with half an ounce each potassium bichromate and gum arabic. Powder the last three ingredients and even the logwood if you like, as it will take the color out quicker; or you can use the prepared extract of logwood at the rate of 1 ounce to a gallon of water. A solution of iron sulphate in 12 times its weight in water is used sometimes. See also SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, for formula for shoemaker's ink.

(22) K. S. N. L. Co. write: We are experimenting with paints, japans, etc., in our nut locks, to prevent rust, and have been recommended to you for the name of any paint or any combination of chemicals, or receipt, which when applied to iron will prevent or in a large measure do away with rust. A. The following by M. Zein is worthy of trial: Mix 80 parts pounded brick, passed through a silk sieve, with 20 parts litharge; the whole is then rubbed up by the muller with linseed oil, so as to form a thick paint, which may be diluted with spirits of turpentine. Before it is applied the iron should be well cleaned. From an experience of two years upon locks exposed to the air and watered daily with salt water, after being covered with two coats of this mastic, the good effects of it have been thoroughly proved. See also article on "Varnishes for Protecting Iron," SCIENTIFIC AMERICAN SUPPLEMENT, No. 226.

(23) J. N. says: An artesian well, one foot in diameter, throws 25 gallons per minute, and the overflow will all run through an inch pipe. Now, if I drive an inch and a half pipe down to the same depth, close by, can I expect the same overflow, that is, will as much water run over the top of inch and a half pipe as will run over the top of a foot pipe, the other conditions being alike? A. No. The friction in the 1½ inch pipe will slightly retard the flow; otherwise much depends upon the freedom of the opening at the bottom. A 2 inch pipe will be better, and will yield a full flow with a strainer and perforated section at the bottom.

(24) F. G. asks: What are the ingredients of what are called "aniline" colors or "French water colors," "Egyptian colors"—all of the same nature? A. These colors are simply solutions of aniline dyes, many of which can be directly dissolved in water, while others are soluble in alcohol. A little gum water can be added to give consistency if necessary.

(25) R. H. asks the receipt for making the composition called star metal, used for car bearings. A. The composition of the star metal as sold by dealers is only known to those that make it. The following is as near as possible to the composition, and suitable for heavy bearings:

Copper.....	1 part by weight.
Tin.....	10 " " "
Antimony.....	1 " " "

This can be varied to suit almost every requirement by adding tin.

(26) S. & T. say: Having a reservoir full of water and a certain size of pipe out of bottom running down a hill, will more water be discharged 200 feet below than will be at 100 feet, say a 1 inch pipe throughout? The question is whether the additional fall will cause the water to enter the 1 inch any faster in the one case than the other. Should not the inlet be larger? A. If lengths between each station are the same, no more water will be discharged at 200 feet than at 100 feet. Make the upper section larger for more flow at the bottom.

(27) F. C. C. desires us to inform him the best and safest engine for light work, such as to run coffee mill, sewing machine, pump up small amount of water, etc.; something cheap but good and particularly safe, and where to purchase it; something that would be safe in the hands of a lady or young girl. A. There are several forms of gas engine, which, as well as the hot air engine, are safe, and not very expensive.

(28) J. H. writes: I have a lot of cotton stockings which when worn color the feet, the dye coming out; they have been washed and boiled to no effect. Will you please tell me how to fix the color? A. We know of nothing to recommend you. The coming off of the coloring material is an evidence that an inferior quality of dye was used. Colored hosiery should be put into a strong solution of salt and water, and dried in the shade or in a heated room before use. Wash on the wrong side in lukewarm water with pure soap, perfectly free from acid, rinse well in clean cold water, and then dry as previously stated.

(29) T. F. B. asks for some practical work giving instruction in the art of wood engraving for a lad who has an inclination in that direction. A. There are no books of any real value to a beginner in this direction; it requires a pretty long apprenticeship, and is very tedious work, and then success or failure depends largely upon the natural capacity of the individual for this peculiar work.

(30) J. F. K. asks the highest boiler pressure the government allows to be carried. A. This is for the government inspector to decide, according to the build and strength of the boiler, and the use to which it is put. There are no specified limitations.

(31) J. H. P. asks if there is any known method of softening raw ox hide, so that it can be moulded into any shape, and then will recover or assume its original strength, without becoming stiff and brittle like glue. A. There is not, except by tanning, and that gives the substance a decidedly different nature; all ox hides, when dry, are naturally stiff and

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brittle, like glue. 2. In the burning of large sulphuric acid chambers, what amount (per cent) of the lead is likely to volatilize? A. The loss of lead would be about 25 per cent. By volatilization the amount driven off would be exceedingly small. 3. Will you mention any instances where acid chambers have been destroyed by fire? A. Works burned are the Marcellin, of Bridgeport, Bowker, of Elizabethport, Crenshaw, of Richmond, Merrimac, of Boston.

(32) A. L. B. says: Please tell me the chemical composition of elderberry juice, before made into wine, and if you think it practicable to buy the elderberries in large quantities cheaply without raising them on plantations? A. The chemical composition of the elderberry juice has probably never been determined. It is a mixture of various ingredients which would be very difficult to isolate. The answer to the second question depends entirely upon the amount of capital required for the purpose of raising the berries; if that exceeds in amount the value of a given quantity of berries at the market price, then of course it is best to buy. This is not a question of opinion, it is rather one of comparative values, and must be settled by obtaining the information relative to the possibilities of raising and also of disposing of the elderberries.

(33) S. S. S. asks: What pressure plates will stand with safety from an eighth to a quarter inch thick, made into a vessel to hold from 2 to 3 cubic feet of air, and what is the best metal for strength with least weight? A. Large tubes such as are used for boilers are as light and strong as anything you can get. A 10 inch tube will bear a pressure of 500 pounds with safety. They hold a little over half a cubic foot to a foot in length. Heads should be three-eighths wrought iron, raised and flanged, backed in and strongly riveted and calked.

(34) J. A. T. asks the cause of glass cracking in store fronts, say a 4 lighted half, glass AA double strength, about 36x60, with wrought iron mullions and muntin. They were bedded in putty, and crowded to place with wooden stops. Some of them crack within an hour after putting in, and others twelve months. The buildings are veneered brick. I have also had the same trouble using rubber tubing instead of putty. A. Glass of the size you mention seldom cracks in this climate when carefully set. Imperfect annealing may subject such glass to great strain in a severe climate. We should judge that iron mullions may have much to do in causing fracture in very cold weather. The large plates in New York windows are sometimes fractured in extreme weather from the strain caused by contraction. The crowding to place by wooden stops may also cause a strain by bending that might start a crack at any time. We have nothing better to offer than the suggestion of greater care in setting the glass perfectly free from strain in any direction.

(35) D. F. says: Inclosed I beg to hand you specimen of asbestos. Will you kindly inform me where I can find a market for this article, what it is used for, and what is the price per pound? A. The average spot value of asbestos at the mine is about $30 per ton. The price in New York ranges from $15 to $60 per ton, according to the length and strength of the fiber and its purity. It is used in making liquid and fireproof paints, roofing, piston packing, valve packing, flat packing, covering steam pipes and boilers, fireproof cements, sheet and roll millboard, flooring, felt, etc. It is often used with hair felts and other substances. H. W. Johns, of Maiden Lane, New York, is the largest dealer of it in this part of the country. The specimen sent however appears to be chrysotile, a variety of serpentine, found chiefly in Canada, and there employed, only to a limited extent, however, in the preparation of a variety of textile material. The Canadian Geological Survey could probably give complete information.

(36) W. T. M. asks how the liqueurs "Kümmel" and "Chartreuse" are made. A. The so-called "Doppelt Kümmel" is prepared by dissolving separately, each in a little 95 per cent alcohol, half adrachm oil of anise, and five drops each of the oils of calamus, bitter almonds, and coriander; also dissolve 1 to 1½ ounces oil of caraway in sufficient 95 per cent alcohol to make a clear solution. Incorporate the foregoing with 40 gallons French proof spirit, and add 10 pounds sugar dissolved in 5 gallons water. The green Chartreuse consists of:

Dried lemon balm	500	grams.
Hyssop in flower	250	"
Peppermint (dried)	250	"
Genepi	250	"
Balsamite	125	"
Angelica seeds	125	"
Angelica roots	62	"
Thyme	30	"
Arnica flowers	15	"
Buds of balsam poplar	15	"
China cinnamon	15	"
Mace	15	"
Alcohol at 85°	62	liters.

Digest for twenty-four hours; distill and rectify to obtain 60 liters; add 25 kilos of refined white sugar dissolved by heat in 24 liters of water; mix the whole and make up with water to 100 liters; mellow and color yellow with a mixture of blue coloring and infusion of caramel or saffron. Size, allow to repose, and filter.

(37) W. E. J. asks: Can you inform me where I can communicate with some one who has an invention for lighting the bottom of the sea where the water is from 100 to 150 feet deep, or put me in communication with some one who has the means of locating a wrecked vessel? A. We would refer you to the Edison Electric Light Company, 65 Fifth Avenue. Mr. Edison, we are informed, has experimented in this direction. Or you might write to Gen. John Newton, Chief of Engineers, New York.

(38) J. Q. A. says: I have a summer coat made of mohair, dark gray in color, almost black. Perspiration has given it a very bad odor, though without changing the color. What will clean it without injury? A. Perspiration stains are removable by washing the garment in a strong solution of soda, with a subsequent rinsing with water.

(39) W. P. C. says: I want to know if you can tell me of a good cheap chemical bath that I can use to dip waste tin plate in, to deprive it of its plate to use over again as solder? I want to use hot water, and I know that chemicals will admit water to get hot enough to melt tin, and I want to know what chemical to use to superheat it and melt the tin plating so it can be saved to use over again. A. The accomplishment of your purpose is not practicable. Tin is frequently removed from refuse scraps by treatment with hydrochloric acid and subsequent recovery of tin chloride or tin crystals. This process is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 112.

(40) F. B. says: I have a paper roller with figures embossed in it, working together with a roller of metal (brass). On passing through a wet piece of cloth, the metal roller being hot, the figures on the paper roller get torn up, as the cloth sticks to it very badly. What substance shall I take, to make the paper roller hard, and smooth like glass and also watertight, so as to resist the action of dampness or heat. A. Try thin shellac varnish 2 or 3 coats, drying each thoroughly before putting on the next.

(41) A. M.—To whiten tarnished silver thimbles, rub with a brush and oxalic acid and wash clean with warm soap and water; polish with rouge on a brush.—Answer the questions from the Young Men's Christian Association conscientiously. If they think you worthy of membership, they will receive you.

(42) F. W. C. asks (1) how can I re-ebonize a maple rifle stock in the easiest way? A. Full information in regard to Dyeing Wood Black will be found on page 3301 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 207. The general process of ebonizing wood consists in the application of a solution of iron acetate, sometimes with logwood and sometimes simply alone. 2. What the preparation is which cartridge manufacturers grease their cartridges with? A. A mixture of beeswax and tallow is used. 3. An economical method of greasing small bullet breech caps of 0.22 inch caliber. A. We would recommend that they be dipped or immersed in the above.

(43) B. J. K. asks (1) the name of a work in chemistry that treats broadly on the subject of oxygen and oxidation. A. There is no single book on the subject desired. Roscoe and Schorlemmer's Treatise on Chemistry, vol. i., is very full, but a work on Dynamical Geology would probably be more satisfactory; Dana's Manual of Geology has a chapter in it devoted to this subject. 2. Is iron scale the peroxide of iron? A. The black or magnetic oxide of iron is the combination of ferric (per) oxide with ferrous (proto) oxide of iron. 3. Of what degree of oxidation is iron rust? A. Iron rust is the ferric oxide (peroxide). 4. About what per cent of iron or oxide of iron does ocher contain? A. The theoretical composition of limonite or ocher is 86·6 per cent ferric oxide, 14·4 per cent of water. 5. Are carbonate ores of iron as rich in metal as hematite or magnetic ores? A. Magnetite contains theoretically 72·4 per cent of iron, hematite 70, and eiderate, the carbonate ore, about 56 per cent.

(44) J. A. C. asks for a receipt for making sarsaparilla sirup, such as is used in soda water. Also a receipt for making sarsaparilla such as is sold in bottles. A. Several formulas for sarsaparilla sirup will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 77. The fluid extract to which we presume you allude is prepared by moistening 16 troy ounces of the powdered sarsaparilla with half a pint dilute alcohol; let it stand 30 minutes, then percolate until 3 pints have passed through; evaporate at a moderate heat in a water bath to 1 pint, add 10 ounces sugar, evaporate to 1 pint, and strain while hot.

(45) H. W. asks a formula for Gunther's mead, or one that is as good. A. The ordinary mead is prepared by fermenting honey and modifying the flavor by spices and oils. The following taken from our back files will probably be satisfactory: Take ten gallons of water, two gallons of strained honey with two or three ounces of white Jamaica ginger root, bruised, and two lemons cut in slices. Mix all together and boil for half an hour, carefully skimming all the time. Five minutes after the boiling commences add two ounces of hops; when partially cold put it into a cask to work off. In about three weeks it will be fit to bottle.

(46) M. J. B.—Your machine will run a small arc light very well. One of Browning's small arc lamps would probably be best suited to it. You can purchase these lamps from any of our leading opticians.

(47) F. D.—Your machine will undoubtedly work very well. We only suggested that the later form of Siemens armature might prove more satisfactory. Consult SUPPLEMENT, Nos. 222, 224, and 225.

(48) J. B. L. says: I have seven pounds of No. 16, and five pounds of No. 20 cotton covered copper wire, and wish to know if it can be used for making a dynamo electric machine, and what kind would be best to make to get the best results from the above wire. A. You would probably be able to make a successful machine by following the instructions given in SUPPLEMENT, No. 161.

(49) C. G. Y.—You can pursue a course of electric engineering in Cornell University, Ithaca, N. Y., but if you can secure a situation with some establishment like Edison's or the United States Electric Light Company, it would probably be better for you unless you are able to take both.

(50) T. H. M. asks: 1. Where can I buy a small outfit for electroplating? A. Any of our dealers in electric supplies can furnish you with the outfit you need. Consult our advertising columns. 2. How can I tin steel and iron so as to cover it with a thicker coat than is generally done with the ordinary process using muriatic acid? A. The articles may be well cleaned and dipped in melted tin covered with wax or tallow. 3. Are there any books, or SUPPLEMENTS of your paper, treating on either subject? A. SUPPLEMENT Nos. 310 and 436 give full information on electro plating.

(51) M. E. W. says: 1. In making the chromic acid batteries, in SUPPLEMENT, No. 159, what else can I use for the vessels, besides flower pots, as the acid soaks through and breaks them? A. You can purchase porous cells. 2. Why do you have to use a porous cell? A. The porous cell renders the battery more constant. 3. What will prevent the zinc from becoming so brittle when amalgamated? A. Use pure zinc and less mercury.

(52) W. S. asks: 1. How many feet of wire and what number should I use to make an electro magnet that will hold a weight of one pound? A. About 150 feet of No. 24 wire for cores seven-sixteenths or one-half inch diameter and one and three-quarters to two inches long. 2. Will one gravity battery 6 x 8 be sufficient? A. It would require two or three cells of gravity battery. 3. Is it the number of the wire or the amount of feet that makes the power, the battery being the same in both cases? A. It depends upon the kind of battery, its resistance, etc. For a battery of considerable resistance a fine wire is used, and for a battery of low resistance yielding a quantity current a coarse wire will be required. 4. What is the meaning of ohms of resistance? Is there any way of figuring it, in the way of force or pressure? A. An ohm is a unit of electrical resistance. It is about equivalent to 38 feet of No. 24 wire above referred to, or 330 feet of No. 9 iron telegraph wire (0·155 of an inch in diameter).

(53) J. H. S. asks: How many cubic feet of compressed air, at 200 pounds pressure per square inch, would it take to run a two horse power engine 2 hours; how many compressed to 600 per inch; also at 800 pounds per inch? How many cubic feet will it require to run a two horse power engine 2 hours? What kind of iron would it require to stand the above pressure with safety? Can I compress air and keep it for 3 or 4 days at a time? A. For 200 pounds pressure, 300 cubic feet; for 600 pounds, 100 cubic feet; for 800 pounds pressure, 75 cubic feet. An ordinary boiler shell ¼ inch thick, 3 feet diameter, double riveted, is sufficient for an air tank for 200 pounds pressure. Well made 10 inch wrought iron pipe with inserted wrought iron heads is strong enough for the higher pressure.

(54) J. E. B. says: I wish to cut down a poplar tree 12 feet in diameter, in such a manner as not to injure the timber. Please let me know the best way to do it. A. Ascertain which way it will naturally fall, make a soft bed for it to fall upon of brush, hay, or anything of that nature several feet thick. Then guy the tree with ropes to direct its fall upon the bed. Saw from the side that the tree is to fall, following up the saw with thin wedges to keep the tree from settling upon the saw. When the saw is nearly through, the wood will give way and the tree fall into its prepared bed.

(55) J. S. W. asks: What would be the best measurements of beam and depth for a canoe of 10 or 12 feet keel? The canoe is to be used in rapids and possibly in surf. A. A canoe of 10 or 12 feet keel, for rapids and surf, should have from 44 to 48 inch beam, 20 to 22 inch depth amidships, and 24 inch stern to be safe.

(56) F. P. P. asks: What is the receipt for killing hair on a person's body, or in other words what will remove the hair so it will not return? A. Boudet's depilatory, a frequently used preparation, is made by mixing 3 parts sodium sulphide (crystallized) with 10 parts finely powdered quicklime and 11 parts starch. It should not be applied longer than 2 to 4 minutes. It is said to be very effective and safe. Hair is likewise removed by means of electricity, and a description of the process is given in Duhring's "Diseases of the Skin," 3d edition, page 425.

(57) E. M. C. asks: 1. What is the best formula for a soluble ginger extract, such as is used by ginger ale manufacturers? A. The extract of ginger is made by packing 4 ounces powdered ginger in a percolator, moistening it with a little alcohol; then pour on alcohol until 1½ pints of tincture have passed through. Mix this with 8 ounces syrup. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 270, for a well recommended formula for ginger beer. 2. What is the best way to make lemon sirup from the fruit? A. Take 5 gallons lemon juice, 1 ounce best oil of lemons dissolved in half pint of alcohol; or the rinds of 16 lemons rubbed with sugar to extract the essential oil; dissolve 80 pounds sugar in the juice, and boil for 2 minutes. Skim, then strain.

(58) R. asks: 1. What preparation is there, that by writing on paper will eat or cut the letters away so as to form a stencil, or in other words, how is the papyrograph made? A. A description of the papyrograph, including the ingredients of the ink, will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 225. 2. Give also a formula for making a composition for fastening the edges of pads, tablets, etc.? A. The substance used for this purpose consists of molasses and glue with coloring matter, such as fuchsine, similar to the composition of printers' rollers, with somewhat less molasses, however.

(59) A. C. F. asks about a driven well where the soil is sandy, water being found about 60 feet below the surface; it appears to be in the quicksand, beneath which appears to be clay. In getting water, the sand being fine and mixed with the water passes through the pipe, and is continually drawn up with the water, thus making the water muddy and impure. How can a well be driven under such circumstances so as to make it work well? A. There is no better way of keeping fine sand out of driven well pipes than to make the strainer longer than usual and cover with very fine brass wire cloth, about 60 mesh to the inch. When driven into quicksand, the fine sand that will pass through may be pumped up by working a pump strongly. The larger particles of sand will be drawn against the strainer, and in a short time form a filter stratum around the pipe, which will keep back the quicksand. In this way we have pumped out a half barrel of the fine quicksand, and obtained a clear flow that lasted many years. Sometimes doubling the wire cloth will add much to the durability of the strainer.

(60) P. K. says: I made a whistle 12 inches in the opening diameter; the bell is 24 inches long; the steam opening is one-sixteenth inch. The bell is No. 16 iron. The steam pipe is 2 inches, steam pressure 100 pounds. I have moved the bell all the way from one inch to six inches, but the whistle loses its tone after one-quarter the steam is turned on. Now, is the opening too large? Is the bell too thin iron, and is it too long or too short? Is the steam pipe large enough? Ought the bell to be larger than the steam opening? A. We have never seen a bell made of sheet iron. Should judge that the riveted seams might interfere with the ring. The bell should be the same size or diameter as the steam opening. We fear that the bell is not held firm enough over the steam opening, or may not be exactly round; so that the steam strikes the lip in the same relative position all around the rim, which is very necessary. There is always a best pressure to bring out the full tone of the whistle. There is little use in trying to force it with a full pressure of 100 pounds. The best whistle bells are made of hard brass or gun metal. A steel casting might make a good one, or a piece of boiler flue brazed to a wrought iron disk for a head; anything to make the bell a solid piece and set solid and central upon the steam opening, which should also be a true annulus.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. W. W.—Probably tourmaline, but the specimen is so small and the crystals so indistinct that identification is not an easy matter.—C. R.—The specimen appears to be a partially decomposed variety of limestone or carbonate or lime.—H. H. W.—The specimen is crystallized calcite or carbonate of lime.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

July 8, 1884,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adding machine, B. Adams 301,784
Agricultural implement, F. Horst 301,597
Alarm. See Fire alarm.
Amalgamator, A. C. Bowen 301,557
Amalgamator, P. McElligott 301,619
Anvils, calk attachment for, J. E. Collins 301,567
Axle bearing, car, E. B. Meatyard 301,510
Axle box lid, J. C. Albrecht 301,656
Axle, vehicle, Klopp & Therien 301,725
Bale tie, wire, I. W. Davis 301,482
Banjo, G. E. Rogers 301,832
Bar. See Grate bar.
Bath. See Medicated bath. Portable bath.
Bed, invalid, H. M. Burley 301,477
Beer coolers, buck for, F. T. Cladek 301,675
Belt carrier, C. P. Peterson 301,517
Billiard register, automatic, J. J. Gleason 301,714
Block. See Sawmill head block. Vehicle head block.
Board. See Telephonic switch board.
Boat. See Toy boat.
Boat detaching apparatus, M. Bourke 301,556
Boiler. See Steam boiler.
Bones, phosphatic residues, etc., apparatus for the treatment of, C. W. Flodquist 301,708
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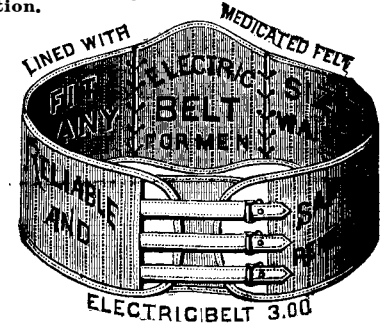

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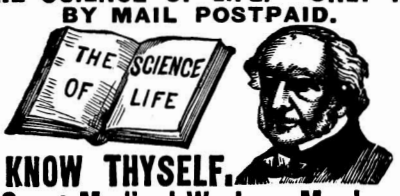

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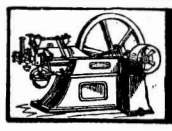

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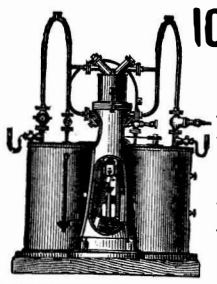

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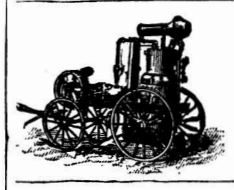

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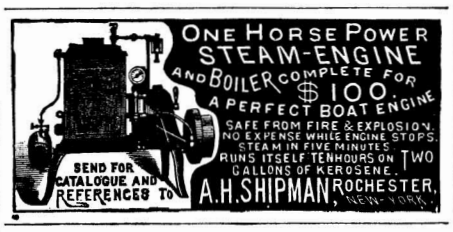
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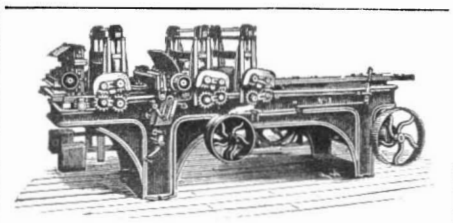

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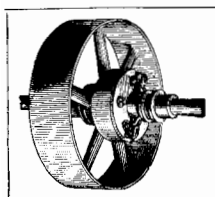

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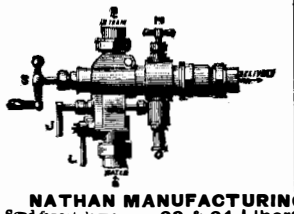

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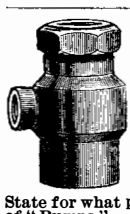

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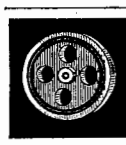

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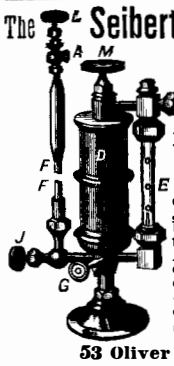

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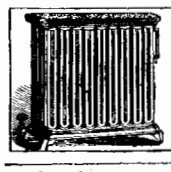

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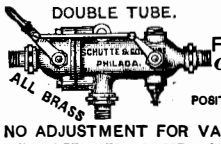

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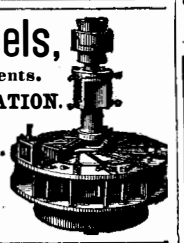

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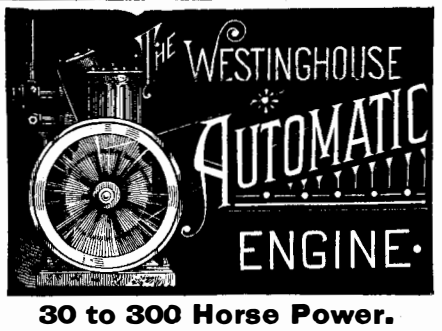

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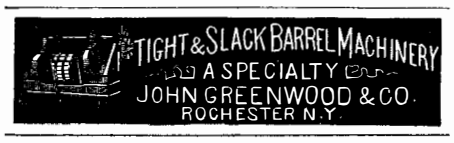

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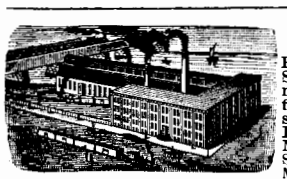

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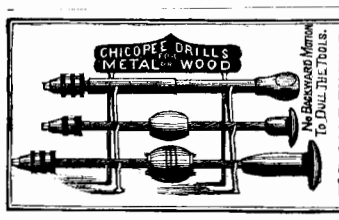

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